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Popular Astronomy

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Popular Astronomy

The First Fifty Years

By CURVIN H. GINGRICH

With this issue, POPULAR ASTRONOMY begins its fifty-first volume. This is, therefore, an appropriate time to look back over the half-century just ended and thus, by noting the successes and the failures, the charting of its course for the future may become clearer. It is, indeed, necessary to go back more than fifty years to find the beginnings of POPULAR ASTRONOMY. Like most movements which are destined to a long life, it did not suddenly come full-grown into existence. It had progenitors. In fact it may be said to be of the third generation.

In the early 1880's a magazine, such as POPULAR ASTRONOMY later came to be, was conceived in the mind of William Wallace Payne, at that time an influential member in a relatively small group of persons who were then directing Carleton College at Northfield, Minnesota, through the early stages of its development. The thought that there existed a fertile field for such a magazine was prompted by the fact that there was then no publication of that kind in America.

Professor Payne, as he was familiarly known, in coming to the Carleton faculty brought with him unbounded enthusiasm for the science of astronomy. As a consequence of his untiring and successful labors, one of the early buildings on the Carleton Campus was an astronomical observatory known as the Northfield Observatory. Later, under Professor Payne's direction, the first and somewhat temporary observatory was replaced by the present Goodsell Observatory. This structure bears the date 1886 on its cornerstone, and in 1890 there was mounted in it a 16-inch refracting telescope which at that time was spoken of far and wide as the largest telescope west of the Mississippi river. At the same time the teaching of astronomy in the college, stimulated by the new equipment, became widely known. Professor Payne, in addition to directing the Observatory and doing most of the teaching of astronomy, established a time service for the benefit of the Northwest in general, and of the railroads, recently constructed or in the process of construction, in particular.

The establishing of an astronomical magazine was simply another method of disseminating the astronomical work of the College over a

larger area. It was in 1882 that Professor Payne, after consultation with the leading astronomers of the day, began the publication of a monthly magazine to which was given the name *The Sidereal Messenger*. The publication continued under this title for ten years—completing ten volumes. The purpose and proposed scope of this new publication are set forth in the first issue, as follows:

> "This paper will be devoted to the interests of Astronomy, as its name implies. It is in no sense a rival for the place or the patronage of such periodicals as the *Nachrichten, Urania, Observatory*, and other leading periodicals that might be named. Those worthy papers go mainly into the professional walks of the science. The practical astronomer needs just such aid as they furnish, and he must have it, and the result is a liberal support for them. Our aim is somewhat different. There are other public interests to serve besides those that are mainly theoretical, or professional; for there are persons, not a few, in every vocation of life, that have a love for the elements of this great science, and they will inform themselves respecting its general progress, if it can be done at reasonable cost. Our purpose, then, is to select that which is best, new or useful from the mass of work that is now going on, in the various branches of astronomy everywhere, and present the same in a terse and plain way, avoiding the use of technical terms, and the details of research as much as possible, that all persons interested may read with care and profit. The first number of the *Messenger*, which is now respectfully offered, must mainly speak for itself."

After ten years, the value of such a magazine was fully recognized and it was thought desirable to extend its influence so as to serve the astronomical profession as well as the astronomical laity. Consequently, a plan was evolved whereby *The Sidereal Messenger* should be replaced by a new magazine, which should contain material of interest to the professional astronomer as well as material for the general reader, and be published under the joint direction of Professor George Ellery Hale, of the Kenwood Observatory, Chicago, and Professor Payne of Goodsell Observatory. Accordingly, it was announced that, beginning with the January, 1892, issue, the name of the publication was to be *The Sidereal Messenger and Astro-Physical Journal*, the title thus indicating its dual rôle. As a matter of fact, however, before any issue had appeared under this name, it was decided to adopt the name *Astronomy and Astrophysics*. Three large volumes, totalling 2758 pages, appeared under this title in the years 1892, 1893, and 1894. Through the experience of these three years it became evident that the combined fields afforded a greater amount of material than could adequately be provided for in a single publication.

Once more a decided change in policy was agreed upon. Professor Hale's interests lay primarily in the direction of modern developments and modern researches in the science. He had by this time become director of the newly erected Yerkes Observatory at Williams Bay, Wisconsin, which had come to be the seat of graduate work in astronomy for the University of Chicago. In order that the magazine might be more readily available for publishing the results of the studies being carried

on at the Yerkes Observatory and at other observatories, the University of Chicago purchased Professor Payne's interests in it and the editorial office was moved to Yerkes. The name of the magazine was now changed to *The Astrophysical Journal.* It appeared first under this name in January, 1895. As its issues comprise two volumes a year, volume 96 was completed in 1942, the journal being thoroughly known by this time the world over as the leading technical publication in its field.

When this transfer became imminent, Professor Payne revived his earlier thought regarding a magazine for popularizing astronomical information. He thought such a magazine would be of value to teachers and students of astronomy as well as to all intelligent readers. Some of his contemporaries thought such a project could not be carried out successfully, because they felt that astronomical facts could not be presented without technicalities. Not daunted by this attitude on the part of those whose opinion he valued highly, Professor Payne launched a new magazine in September, 1893, under the name POPULAR ASTRONOMY. He lived until 1928, when the magazine was in its thirty-sixth volume, and had the satisfaction of knowing that his early judgment had been abundantly vindicated. A large-sized portrait of Professor Payne occupies a prominent place in the editorial office and from the characteristically benign expression in his countenance those who are responsible for the management of the magazine today receive the continuing inspiration of its founder.

The accompanying figure is a reproduction of the front cover of the first issue. Those whose memories carry them back fifty years and those younger persons who are familiar with the astronomical history in this country at that time will notice among the names of the contributors the names of some of the prominent astronomers of that period. In addition to the Frontispiece mentioned in the Contents, this issue contained as another illustration a double-page chart of the orbits of the Jupiter Family of Comets, including Holmes' Comet. This chart is a reproduction of a drawing by A. G. Sivaslian. Mr. Sivaslian, an Armenian, was then a student in Carleton College from which institution he received the degree of Doctor of Philosophy in astronomy. After completing his work here, Dr. Sivaslian went to Turkey and took up teaching in Anatolia College in Marsovan. He was one of those who suffered deportation and other persecution which was inflicted upon the Armenians in the early years of World War I. It is thought that he, with others, was driven into the desert and that he perished there. Attention is called to the fact that Planet Notes, Comet Notes, and General Notes, departments appearing in the first issue, have been continued throughout all the issues to date. The advertising pages in this issue list the offerings of seven textbook publishers, five colleges, one instrument firm, one Educational Bureau; also the solicitation of a railroad company encouraging the public to use its facilities in going to the World's

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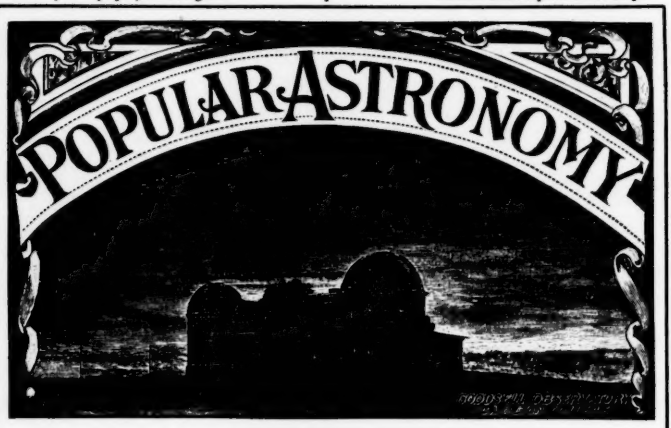

BY THE WORD OF THE LORD WERE THE HEAVENS MADE.

September 1893

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FRONT COVER OF THE FIRST ISSUE OF POPULAR ASTRONOMY
(THE BUILDING PICTURED IS GOODSELL OBSERVATORY)

Fair in Chicago! Typical items appearing in the General Notes of this issue are the following taken from pages 45 and 47.

> This part of our publication will be open to appropriate questions and brief answers. Send them in early each month, so that there shall be time for best answers to queries and comparison of views of competent authority when desirable. Here is an example: "Where is the international date line?" This can best be answered, probably, by a small hemisphere map showing its position from the Arctic ocean, north of Bering Straits, in irregular course, till it reaches the Antarctic ocean. We will try to give such a map next time.
>
> Personal Sketches.—Another feature of popular interest is under consideration. It has seemed to us that our readers would be helped, if we could furnish from month to month good half or third page pictures of eminent scholars or observers in astronomy. The sketch to accompany the illustration should be very brief, not to exceed a page of printed matter. The object of this is to familiarize interested readers with the living men and women who lead in opinion and ability in astronomy. Other lines of publication do this creditably, why is this line an exception? Of course every person so represented should see and pass judgment on all that is to be published before it appears, to avoid all error of statement or other unfavorable representation.

Professor Payne was not only the founder of POPULAR ASTRONOMY but also its editor, its publisher, and its owner until 1909. He was assisted on the editorial side by the persons associated with him in the department of astronomy and in the work of Goodsell Observatory from time to time. He was also ably assisted on the business side by his daughter, Miss Jessie V. Payne. There are persons still living in Northfield who have vivid recollections of Professor Payne's daily excursions from the observatory on the campus to the printing office in the town. They say that on these journeys Professor Payne invariably carried a basket on his arm, the basket containing manuscripts, proofs, cuts, and sometimes pages of type. In the early years Professor Payne had a compositor's room in the observatory, equipped with the fonts of type necessary for the needs of the magazine. When the type was ready for the press, the paged forms were transported to the printing office, three-fourths of a mile away. When the printing was finished the type was returned to the observatory, redistributed and reset for the next issue. Later the type fonts were transferred to the printing office thus obviating the necessity of transporting the heavy metal back and forth. However, the composition was continued by hand until 1919.

Professor Payne retired from active service on the faculty of Carleton College at the close of the calendar year of 1908. Soon thereafter the Elgin National Watch Company requested Professor Payne to come to Elgin, Illinois, to superintend the construction and equipping of an observatory for the purpose of determining accurate time from the stars. Having the experience of carrying out a similar program at Goodsell, Professor Payne was excellently qualified for the undertaking. Moreover it was an assignment very much to his liking. Consequently, although more than seventy years old, he entered upon this new task with

the zeal and enthusiasm which characterized his whole life. He brought the project to a successful conclusion, and twenty years later, at age 90, he was ready for his second retirement. He was then made Director Emeritus of the Elgin Observatory. At our request at that time he prepared an account of the years he devoted to the Elgin time service. This account was neatly and legibly written by him in long hand. It was published in POPULAR ASTRONOMY, **35**, 1, (1927). The time service which he instituted for the Elgin National Watch Company is a continuing feature of the activities of that company.

In 1910 Carleton purchased the magazine and its equipment from Professor Payne and since that time has published it as one of the activities of Goodsell Observatory.

At the time of the retirement of Professor Payne, the responsibility for his several offices, namely, chairman of the department of mathematics and astronomy, director of Goodsell Observatory, and editor of POPULAR ASTRONOMY, devolved upon Professor Herbert Couper Wilson, his associate. Professor Wilson was born on a farm near Northfield, attended the Carleton Academy, was graduated from Carleton College, and later became a member of, and for a number of years the dean of, its faculty. Except for a few years which he spent at the Cincinnati Observatory and at the United States Naval Observatory in preparation for his duties at Carleton, he spent his entire life as a resident of Northfield. Among other extensive and important duties he continued actively in charge of the editing and managing of POPULAR ASTRONOMY until his retirement in 1926. Professor Wilson died in 1940.

When Professor Wilson moved into the large place left vacant by Professor Payne, the writer was called to fill the vacancy created by Professor Wilson's promotion. This sequence of events did not bring the writer into intimate contact with Professor Payne, although he had the pleasure and the benefit of several visits with him in the years which followed. The writer, however, worked in close association with Professor Wilson from 1909 to 1926. For seventeen years we met almost daily in the office of Goodsell Observatory. During these years much of our work was done jointly, Professor Wilson leading the way. After the day's teaching of classes in mathematics and astronoomy was done, if the sky was clear, we spent a part of the night in the dome making observations of comets, or asteroids, or variable stars, or double stars. When the nights were cloudy we worked side by side on comet orbits or ephemerides, the one checking the work of the other, or possibly, we read proof or worked separately on plate measurements and reductions. Throughout this period, in editing the magazine as well as in all of his other work, Professor Wilson always maintained a scholarly attitude toward study, an unswerving loyalty to duty, an unfaltering firmness in friendship, and a noble Christian spirit in all relationships.

From the time of the first issue of *The Sidereal Messenger* until the present, all of the typesetting and all of the printing have been done in Northfield, mostly by the Northfield News Company. Through years of experience with the somewhat exacting requirements of a semi-technical publication, the personnel of this office has acquired skill in the printing art far greater than one might expect to find in a printing office in a small community. Persons in this office whose names should be mentioned in this survey, because of their many years of service rendered in the mechanical aspects of POPULAR ASTRONOMY, are Joseph L. Gannon, superintendent and make-up man, Arne Winger, linotypist, and Ole Grove, pressman. Some of these because of retirement and army demands have recently been replaced by younger men who are maintaining the high standards set by their predecessors.

The writer may, perhaps, be permitted some comments based upon his experience over a period of more than thirty years with this magazine.

It is a remarkable thing that practically never is there a scarcity of available material. This is the more surprising when it is realized that in no instance has monetary remuneration been made for contributions. Many articles are sent to the office which might well be used if space were available, but which are returned because there is a possibility of printing them only after a long delay. To be sure, there is a constant stream of material which is deemed unsuited to the purpose which this magazine strives to fulfill. Astronomy, perhaps more than any other science, presents questions which prove to be enticing to persons without adequate background for treating them intelligently. Consequently, many theories are proposed which are entirely untenable for reasons which the proposer himself oftentimes is unable to comprehend. Astronomy seems to possess a peculiar fascination for beginning poets also. A small amount of space can be devoted to poetry of this kind but most of the poetry submitted must be returned.

Sometimes quite unusual suggestions and requests are made. The following are typical. Recently the suggestion came from a gentleman more than eighty years of age that we abandon the Euclidean theory of space because it does not conform to some measurements which he had made. Also recently a request was received in the following words, "In the sixth grade we are studying stars. We thought you might give us some information on the subject."

A list of contributors to the pages of POPULAR ASTRONOMY contains the names of the contemporary leaders in this science. And the list is not restricted to American scientists. Contributions are received from England and, indeed, from all European countries; also from Africa, the West Indies, South America, Japan, China, and India. Some of the principal articles require a certain amount of scientific training for a complete comprehension. However, the intention is that all contri-

butions used shall contain something that is within the reach of the average reader.

At this writing the subscriptions to foreign countries are necessarily greatly reduced in number. Instead of between two and three hundred, only about seventy-five copies are now being forwarded beyond this hemisphere. The remaining ones are those going to England, Africa, and Australia. It is, of course, hoped that after the war the foreign subscription list will be restored.

And so, although the name *The Sidereal Messenger* has been replaced by *Astronomy and Astrophysics,* and it in turn by POPULAR ASTRONOMY, this magazine hopes to continue to be in its second half-century, as it has been during its first half-century, a friendly messenger to the astronomical fraternity of the world.

We are gratified and pleased to have received a number of generous and complimentary messages in recognition of this issue, number 501, the first number of volume fifty-one. They follow here in the order in which they have come.

As one who has followed with interest the career of POPULAR ASTRONOMY for over forty years, I can frankly state that I have always considered the columns of the magazine as fulfilling the needs of both professional and amateur in every way.

Surely to the amateur observer the space devoted to variable star observations and later the notes on variable stars have proved a genuine incentive. The columns of POPULAR ASTRONOMY have been devoted to the advancement of variable star studies for over three decades, and it was with the coöperation of the late editor, Professor H. C. Wilson, that the American Association of Variable Star Observers was able to start on its long and apparently worthwhile career.

LEON CAMPBELL.

HARVARD COLLEGE OBSERVATORY.

Please accept my heartiest congratulations on the completion of fifty years of POPULAR ASTRONOMY. This magazine has filled a very distinctive and unchallenged place in the field of astronomical literature. Its timely articles, reports, and news of astronomical happenings and personnel have given world-wide distribution to welcome information of scientific progress. This periodical has made an important contribution to the rise of astronomy in the United States, and it well deserves the recognition and esteem in which it has been held throughout the astronomical world.

HARLAN T. STETSON.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

The progress of any science is so closely related to the means available for spreading knowledge about it and its achievements that it is hardly

possible to exaggerate the importance of the scientific journals in any particular field. For fifty years POPULAR ASTRONOMY has successfully endeavored to create and maintain an interest in its own field among its subscribers whether they be astronomers or readers who are merely seeking for the enrichment of their own intellectual experience. I recall that in my student days some forty years ago I pored over its pages with the intensest fascination as vista after vista was opened up and I have no doubt that many others who later turned to astronomy as a life work have had the same experience.

A. H. JOY.

MOUNT WILSON OBSERVATORY.

The completion of the 50th volume of POPULAR ASTRONOMY is an event which merits special recognition. This half-century has brought the greatest progress in astronomical knowledge of any similar period in the past. What is equally noteworthy is the spread of astronomical interest among the general public which is made evident by the increasing number of amateur astronomers. To furnish reliable information in nontechnical form to these lay students, to make helpful suggestions for work of their own, and to provide an outlet for their findings is the task to which POPULAR ASTRONOMY has devoted its efforts. The continued appearance for fifty years proves the success which the editors with the aid of their many collaborators have had and for which they are to be congratulated.

ROBERT J. TRUMPLER.

UNIVERSITY OF CALIFORNIA, BERKELEY.

Let me congratulate you on the completion of 50 volumes of POPULAR ASTRONOMY. It has been a source of news, scientific information, and inspiration for young astronomers for many years. Its contribution to the progress of astronomy in America has been very great.

F. R. MOULTON.

SMITHSONIAN INSTITUTION BUILDING, WASHINGTON, D. C.

Congratulations on having reached the semi-centennial milestone in the publication of the grand old magazine, POPULAR ASTRONOMY! Ever since my boyhood days on the farm, when I examined the copies in our mid-western public library, especially for data on the planets and for notes on occasional comets, I have found the magazine of greater and greater interest to the amateur and to the teacher of astronomy.

CLYDE FISHER.

AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK.

POPULAR ASTRONOMY, through its fifty years of publication, has been an excellent medium for the dissemination of astronomical facts and theories—not only for the professional astronomer but for the amateur as well. In no other science is the work of the amateur as important

as in astronomy. Whether it is in the discovery of novae or comets or in systematic observations of variable stars or meteors, the amateur has contributed greatly to our understanding of the universe. Because POPULAR ASTRONOMY is one of the few scientific publications available to the professional and the amateur alike, may it afford within its next fifty years an even closer bond of thought exchange that will be increasingly beneficial to both groups.

N. T. BOBROVNIKOFF.

PERKINS OBSERVATORY.

What astonishing changes have been witnessed by my generation of American astronomers, those a little older or a little young than myself, in the fifty years since the gay nineties! In the special field of research of the Leander McCormick Observatory, that of stellar distances, what amazing progress has been made. In the 55 years between 1838, the date of the first parallax, and the starting of POPULAR ASTRONOMY, there had been an average of one trigonometric parallax per year completed. Now in contrast, observatories including ourselves have an average of over 50 parallaxes per year. Their accuracy compared with the early determinations is represented by the next decimal place.

S. A. MITCHELL.

LEANDER MCCORMICK OBSERVATORY.

Permit me to extend my hearty congratulations to POPULAR ASTRONOMY on the celebration of its Jubilee, and to you, its editor, on keeping the successive numbers, as they have followed each other through the recent years, up to the standards set by its founders and earlier editors. This is no small achievement, as I know, perhaps better than some of your other readers. I found that editing the *Publications of the Astronomical Society of the Pacific* meant a lot of time and hard work, even though I had able and active co-editors, and, in a general way, freedom of choice in the matter of hours for work. I had no classroom engagements, very few committee meetings, few of the many other interruptions that take up so much of the time of an active member of a College Faculty. You have had all these and yet have found time to do your editorial work and do it well. So once again, congratulations.

POPULAR ASTRONOMY stands for certain ideals that one could ill spare. To put it briefly, it stands for the human values in astronomy and has to steer its way carefully between such strictly technical journals as the *Astrophysical Journal,* on the one side, and the heavily illustrated popular journals like *The Sky and Telescope* on the other. These have their places, too, and are indispensable, but neither they nor the *Publications* and *Leaflets* of the Astronomical Society of the Pacific quite take the place of POPULAR ASTRONOMY.

Let us hope that fifty years from now, POPULAR ASTRONOMY may

celebrate its centenary and still be found as helpful and forward-looking as it is today.

ROBERT G. AITKEN.

1109 SPRUCE STREET, BERKELEY, CALIFORNIA.

Congratulations on the completion of fifty volumes of POPULAR ASTRONOMY. I remember very well when the first number appeared and I have probably read something in every number since that time. The magazine has rendered important services to astronomy over the years, not the least of which has been the publishing of the reports of the American Astronomical Society. We are reminded of the enduring work of the founder and first editor, W. W. Payne, and of his successor, H. C. Wilson; and we are confident that under the present management POPULAR ASTRONOMY will continue to be as successful as it has been in the past.

JOEL STEBBINS.

WASHBURN OBSERVATORY.

POPULAR ASTRONOMY has long filled a unique and useful rôle in furnishing astronomical information of a general nature, or, as the name implies, "Popular Astronomy" to a large number of readers. I began reading Volume III in 1895 and have read with interest most of the 470 numbers as they have come out since. I trust this emphasizes my congratulations upon the completion of 50 excellent volumes, and my good wishes to the editors for an equally successful future.

H. R. MORGAN.

U. S. NAVAL OBSERVATORY.

I want to congratulate "P.A." on its Golden Jubilee. I am proud to be the possessor of the complete set, with not a single number missing—at least for the first twenty-five years.

In those formative years when the American Association of Variable Star Observers was a puny, struggling infant, "P.A." was the efficient and interested nurse who guided it to maturity and strength. The records of those early days, as published in POPULAR ASTRONOMY, are priceless as scientific history.

I will always cherish the memory of my own friendly, personal relations both with the publication and its editors.

May its life be long and prosperous!

DAVID B. PICKERING.

EAST ORANGE, N. J.

Throughout a half century POPULAR ASTRONOMY has given a service to professional astronomers, amateur astronomers, and many general readers for which we should all be grateful. I wish for you and your collaborators every success in its continuation.

JOHN C. DUNCAN.

WHITIN OBSERVATORY.

For over thirty years I have been a contributor to POPULAR ASTRONOMY and for nearly a decade I have edited the *Contributions of the Society for Research on Meteorites,* which have appeared regularly in this magazine. As the official journal of both the American Meteor Society and the Society for Research on Meteorites and as the medium of publication of many independent papers about meteorites and meteors, POPULAR ASTRONOMY is, in my opinion, the world's leading periodical on these subjects. I take pleasure in embracing this occasion to express my appreciation of the invaluable service that POPULAR ASTRONOMY is rendering the cause of meteoritics and to congratulate it on the commencement of its fifty-first volume. May its second half-century of existence be even more successful than its first!

UNIVERSITY OF CALIFORNIA, LOS ANGELES. FREDERICK C. LEONARD.

On this 50th anniversary of the founding of POPULAR ASTRONOMY, it comes back to me that my first astronomical observation, made with Professor Leavenworth, was reported in this journal. Memories of Professor Payne, and of the lovable H. C. Wilson, are revived. POPULAR ASTRONOMY has had a useful career, and I extend greetings and best wishes on this occasion, and wish the publication "many happy returns."

ALLEGHENY OBSERVATORY. KEIVIN BURNS.

In the winter of 1891 I came into possession of a 3½-inch telescope. Desiring to know what would aid me in its use, I wrote to Professor Charles A. Young, under whom my class (Dartmouth College 1878) had studied astronomy.

In his kindly given advice, he recommended me to purchase Klein's Star Atlas and his own recently published Lessons in Astronomy, and to subscribe to *The Sidereal Messenger.* My subscription to this began with the May issue of 1891.

I found this so interesting and helpful that my subscription has been renewed, through *Astronomy and Astro-Physics,* and through POPULAR ASTRONOMY, down through the years until the November (1942) number is now upon my desk.

My interest in this very valuable publication has never lagged, and I have found it of great help as an aid to keeping in touch with the constantly increasing progress during the last five decades in the field of astronomy.

To an inquiring amateur, as I was in 1891, or to any one interested in working in any branch of astronomy, I would extend Professor Young's advice to me: POPULAR ASTRONOMY should be a part of his equipment.

The information and pleasure which POPULAR ASTRONOMY still brings to this amateur star-gazer, now 86 years old, is helping him to forget age and to retain something of youth.

TILTON C. H. BOUTON.

BOX 863, ST. PETERSBURG, FLORIDA.

No astronomical publication exists, to my knowledge, which has for so many years served as a liason medium between the interested layman or amateur and the professional astronomer.

Between the very technical journals and the smaller publications which are issued more or less for the hit and run reader, the wide and interesting middle ground signals to POPULAR ASTRONOMY to continue its mission with high courage.

Tribute to the memory of the founder and the succeeding editor and words of congratulation and appreciation to those who now publish POPULAR ASTRONOMY are gladly spoken at this time by us who read and enjoy this journal.

OLIVER J. LEE.

DEARBORN OBSERVATORY.

As the coming January issue of POPULAR ASTRONOMY will mark the beginning of your Volume 51, it seems fitting to voice my appreciation of the great pleasure I have had in knowing your magazine intimately for many years.

Your work in the astronomical world is known as well abroad as in this country. The world-wide dissemination of celestial research and news would be seriously curtailed if it were not for the outstanding part POPULAR ASTRONOMY plays in such important activities. Very few magazines have lived through a period of half a century, and at the beginning of the next half I bespeak for you even greater prosperity.

Mr. Perkins joins me in best wishes for the continued success of POPULAR ASTRONOMY.

C. W. ELMER.

THE PERKIN-ELMER CORPORATION, GLENBROOK, CONN.

I have been a subscriber to POPULAR ASTRONOMY for about thirty-five years. It was my esteemed friend, Doctor Brashear, who suggested my becoming a subscriber, at the time of renewing my interest in astronomy. Another friend, Doctor Alden W. Quimby, bequeathed me his collection of this valuable (or should I not say invaluable?) journal many years ago so that I now have it in its entirety, and appreciate it more than I can say in a few words.

H. B. RUMRILL.

TREDYFFRIN OBSERVATORY, BERWYN, PENNSYLVANIA.

You must have a feeling of great pride and satisfaction as you look back upon the past 50 volumes of POPULAR ASTRONOMY, filled as they are with the record of the science's great achievements during this period. With the wonderful instrumental advances that have come recently or are now in prospect for immediate development in the years following the present war, your next 50 volumes are certainly going to tell a story that is even more remarkable. I know that you and your

successors who may come in the (distant, I hope) future, will preserve its high standards.

JAMES STOKLEY.

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

For fifty years POPULAR ASTRONOMY has recorded the events of the astronomical world and published accounts of astronomical research. At this time when the magazine begins its fifty-first volume, I wish to extend congratulations for past achievements and good wishes for the future to the present editor and to the collaborators, and to all others who have had a part in making the magazine what it is today. May the next fifty years be even more successful than the period just ended.

The development of astronomy during the last fifty years has been remarkable. The volumes of POPULAR ASTRONOMY give the story of this advance year by year. In many cases the articles were written by those who were actually doing the research and so give the contemporary point of view. Besides reading the current numbers as they appear, I have always enjoyed browsing through the back numbers of POPULAR ASTRONOMY, and have found such reading not only interesting but profitable.

In these days of global war when science must necessarily be devoted chiefly to the development of instruments of destruction, it is pleasant to look back to peaceful days when scientific research could be pursued for its own sake and to hope that such days will return before POPULAR ASTRONOMY is much older.

IDA BARNEY.

YALE UNIVERSITY OBSERVATORY.

On this Thanksgiving Day I am very happy to express my thoughts on the occasion of the opening of the 51st year of POPULAR ASTRONOMY.

My first acquaintance with the journal dates from twenty years ago; there are others who have known it much longer, but they can say at least no more than I, for that twenty years embraces the whole of my astronomical life. It was my only contact with current astronomy for several years, until I went to college and learned that there were actually other astronomical journals published!

Because I am interested in the relaying of astronomical information to the uninitiated, I find it necessary to check up on my own knowledge of intimate details in the history of the development of astronomy, particularly since the great impetus given to astronomy by the large telescopes constructed in this country about fifty years ago. I can always find what I want in POPULAR ASTRONOMY, most of it, I must confess, in the finer print in the latter half of each number.

My thanks go to the journal and to the long period of distinguished editing for being receptive to me when I aspired to authorship; for being equally receptive to others who, like me, had something they wished to say in public. The tolerance exhibited in the pages of POPU-

LAR ASTRONOMY is to be excelled only by the good taste of every issue. My hope is to be able to say as much, or more, about all the issues as they keep coming through many more years.

ROY K. MARSHALL.

FELS PLANETARIUM, PHILADELPHIA, PA.

I have had the pleasure of reading POPULAR ASTRONOMY from Volume I to date and have known all its editors personally.

Hearty congratulations upon the successful completion of its first half century and best wishes for the future.

FREDERICK SLOCUM.

VAN VLECK OBSERVATORY.

At the close of the fiftieth volume of POPUAR ASTRONOMY, one can look back on a long period during which this journal has rendered valuable service to those interested in astronomy, as readers and as amateur and professional observers. Those in charge of the publication are to be congratulated on good selection of material and able editorship. The "exclusive" features, among which are the sections on meteors and meteorites, have provided a continuous record of observations in these fields. The group pictures, in connection with reports of meetings of the American Astronomical Society, will have increasing interest as the years pass.

ARTHUR S. KING.

MOUNT WILSON OBSERVATORY.

POPULAR ASTRONOMY has finished a half century of life and begins on another half century with the best wishes of thousands of appreciative readers. For the past forty years I have found it readable, informative, and stimulating. It has filled a unique and indispensable place in astronomical education. It has put Carleton College on the map, astronomically speaking, and has reflected great credit on its editors and publishers.

WILLARD H. GARRETT.

BAKER UNIVERSITY, BALDWIN, KANSAS.

Everyone interested in astronomy, whether as professional astronomers or laymen with a strong appreciation of the science, will wish to extend to POPULAR ASTRONOMY his hearty congratulations on the completion of fifty years of publication. The journal has filled a most useful place in astronomical literature, combining articles of technical merit with those in simpler language which can be understood by every intelligent reader. As POPULAR ASTRONOMY passes into its second half-century the good wishes of every astronomer will follow it.

MOUNT WILSON OBSERVATORY. WALTER S. ADAMS.

POPULAR ASTRONOMY is an excellent journal for the publication of most of the papers produced by those working in observatories with

limited equipment, and whose duties are primarily teaching rather than research.

I have been contributing papers to POPULAR ASTRONOMY with regularity since 1918 and expect to continue contributing to and reading the journal.

Our best wishes are extended to the editors on the occasion of the journal's fiftieth anniversary.

C. C. WYLIE.

UNIVERSITY OF IOWA, IOWA CITY, IOWA.

It is indeed a duty and a pleasure to acknowledge the value and good service POPULAR ASTRONOMY has been to me. The one outstanding reason for my admiration of POPULAR ASTRONOMY is the high standard it has maintained in the dissemination of accurate astronomical information, both for the professional and the amateur astronomer, as well as the layman.

As a historian of astronomy, it has served me faithfully these past forty-eight years. I sincerely wish you and succeeding editors many years of continued and increasing success.

FREDERICK E. BRASCH.

THE LIBRARY OF CONGRESS, WASHINGTON.

In addition to its function of presenting to students and the public the popular phases of current astronomical research, POPULAR ASTRONOMY has served uniquely for fifty years as an invaluable organ for the publication of observations and reports by certain groups of professional and amateur astronomers. The value of this continued presentation of the work of such organizations as the American Meteor Society, the A.A.V.S.O., and the Society for Research on Meteorites cannot be over-emphasized, for these have played an important part in professional studies as well as in advancing the general interest in astronomy.

POPULAR ASTRONOMY undoubtedly will survive the war period and we may look forward to another half-century of its publication.

HARVARD COLLEGE OBSERVATORY. HARLOW SHAPLEY.

POPULAR ASTRONOMY since its foundation has played a unique rôle in the development of astronomy in America. From the beginning, its aim has been the publication of expository contributions by our leading astronomers. Thus we find the names of Keeler, Burnham, Barnard, and Parkhurst in the first volume, while volume 49 includes the names of many of our leading contemporaries. The policy of continuously publishing hints for observing the planets, comets, meteors, and variable stars, and the announcement of forthcoming phenomena has made this journal indispensable to the serious minded amateur. By publishing the observational material of the amateur, POPULAR ASTRONOMY has provided means for self-expression and at the same time furnished the professional astronomers with useful data.

It is difficult to find another branch of science where the serious amateur can and does contribute more significant aid for its advancement.

That the professional does not neglect POPULAR ASTRONOMY may be judged from the frequent references to it in other journals. Often he finds data which are not available elsewhere. The scholarly articles of exposition summarizing for him fields in which he is not specializing prove of great value.

Like *Die Sterne* in Germany and *L'Astronomie* in France, POPULAR ASTRONOMY bridges the gap between the descriptive and pictorial magazines, and the professional journals.

It is evident that the founder, Professor William W. Payne, formulated and put into effect a sound policy. The wisdom of this policy, adhered to by suceeding editors, is proved by the fact that POPULAR ASTRONOMY has survived the inevitable storms which are bound to come in an interval of fifty years.

J. J. NASSAU.

WARNER AND SWASEY OBSERVATORY.

As one who has intimately known POPULAR ASTRONOMY for nearly its half-century of existence, I wish to add my word of appreciation for the services it has rendered to the astronomical fraternity.

I have seen those services grow to meet the need of an ever widening group of amateur and professional astronomers.

Under the wise guidance of you and your collaborators the second half-century opens with promise of even greater service than the first.

CORNELL UNIVERSITY. S. L. BOOTHROYD.

As a reader of POPULAR ASTRONOMY of long standing and as an occasional contributor thereto (first contribution in 1910) I wish to felicitate you on your completion of fifty years of very useful service and to wish for you an even more successful future. On many occasions I have used POPULAR ASTRONOMY as a valuable source of information on the history of astronomy in the United States and Canada.

FLOWER OBSERVATORY. SAMUEL G. BARTON.

For a half-century, POPULAR ASTRONOMY has served as a medium for general discussion of problems of astronomy on a sub-technical but scientific plane. This I regard as its most important function,—as a connecting link, not only between professional and amateur, but between professional astronomers in separate and highly specialized fields.

The next several years will be a critical period for pure science, as distinguished from technology. The activities of all observatories are curtailed; at some the research work is almost at a standstill. This situation must be met and handled in such a way as best to conserve what has been attained. With the coöperation of astronomers, POPULAR

ASTRONOMY can be an important factor in this process of conservation. Now that research has slowed down, and the "drive" of keen competition has lessened, it would be distinctly worth while to take stock of the present status of the science,—to consolidate the position that has been won. Astronomers can perform a service to society by preparing authoritative scholarly summaries of those fields on which they are best qualified to write. Indeed, such activity is a very proper part of the effort to conserve our culture and our civilization.

UNIVERSITY OF MICHIGAN, ANN ARBOR. DEAN B. MCLAUGHLIN.

POPULAR ASTRONOMY has served a wide circle of astronomers, both professional and amateur, over a period of a half-century. Its field of usefulness has not been limited to the confines of this country. It has served as a friendly tie between American astronomers and their colleagues in other parts of the world.

The first volume of POPULAR ASTRONOMY contains articles by James E. Keeler on the Spectroscope and some of its applications; W. F. Denning on Shooting Stars; J. A. Parkhurst on Variable Stars; Daniel Kirkwood on the Asteroids and their Relation to the Planetary System; J. A. Brashear on Glass for Optical Instruments with Especial Reference to Telescope Objectives; S. W. Burnham on How to Find the Orbit of a Double Star; E. E. Barnard on the Fifth Satellite of Jupiter, and many others. In addition one finds Planet Notes, Comet Notes, General Notes, Book Reviews, and articles by interested laymen.

Many of these articles are routine classroom material now but were real news at the time published. Throughout the fifty years, POPULAR ASTRONOMY has continued to give to those interested authoritative statements on various astronomical problems and discoveries by the leading astronomers of the country long before such material could hope to find its place in any textbook.

JOHN H. PITMAN.

SPROUL OBSERVATORY.

I began to subscribe to POPULAR ASTRONOMY in 1901 and that same year its editors published my first astronomical note, which contained observations of Nova Persei. It is hard to estimate what an encouragement this was to a young amateur. In the years since I have been a constant reader of this journal and believed that it has played an invaluable rôle in the spread of astronomical knowledge in America as well as being the place for the publication of important scientific articles and observations. The success of our American Meteor Society, for instance, has been largely due to the possibility of publishing our Meteor Notes. There is no other journal in America which could take its place and I wish it an equally useful and honorable career during its second half-century.

CHARLES P. OLIVIER.

FLOWER OBSERVATORY.

(To be continued)

Astronomy in the Service of Culture*

By ROY K. MARSHALL

Each of us, at some time or other, has heard or has read a general statement which begins somewhat in this fashion: "There is no science which, more than . . . geology, or physics, or astronomy, etc." There will be found protagonists for any science as the "most beneficial," "most exalting," "most ancient," or most anything one can mention. I remember once carelessly remarking before a botanist that astronomy is the oldest of the sciences, and he challenged the claim of astronomy on behalf of botany.

A story has been told of three men who were seated in a club, enjoying after-dinner smokes. One, a geologist, insisted that his science must be considered the most venerable, for geology traces the evolution of the earth over many millions of years. The second, an astronomer, brightened at once, and stated that astronomy must then certainly be more ancient, for it attempts to trace the very origin of the earth from chaos. The third laughed, and remarked that in that case politics must be the oldest pursuit of man, for if there was any chaos about, the politicians created it.

I shall unashamedly plead tonight the cause of astronomy. I shall not insist that astronomy is the oldest endeavor of man, for one must establish certain criteria before he can argue that point. I shall insist, however, that the contribution of astronomy to culture has been most substantial, and that of all sciences it has been pursued as selflessly as, or more so than, any other.

What is culture? A dictionary in my office tells me that it is "the training, disciplining, or refining of the moral and intellectual nature." But I shall prefer to go to a statement by Rene Descartes, the French mathematical philosopher of three centuries ago, who spoke thus of the services of science:

> "When we know the force and action of fire, water, air, the stars, the heavens and all other objects as we now know the various trades, we shall make ourselves masters and possessors of life. . . This will not be solely for the pleasure of enjoying with ease . . . the good things of the world, but principally for the preservation and improvement of human health which is both the foundation of all other goods and the means of strengthening the human spirit."

The means of strengthening the human spirit: That shall be my definition of culture. Where, then, does astronomy stand in this matter?

*An address before the Amateur Astronomer's Association in the Roosevelt Memorial, American Museum of Natural History, New York City, October 7, 1942; also before the National Capital Amateur Astronomer's Association, The National Museum, November 7, 1942.

Edwin Arnold said, "Astronomy will eventually be the chief educator and emancipator of the human race." To primitive man, the recurring display of a star-studded sky must have been a baffling yet inspiring sight. We can imagine him as he stood before his cave before retiring to its protection and shelter for the night; he lifted his eyes and looked through shaggy brows to the spangled sky. Could he help gaining in spiritual stature? Could we not reasonably believe that because he raised his eyes to the stars he learned to walk upright—he changed from brute to man?

Through the ages, certain ones of these our ancient unknown ancestors, endowed with a blessed inquisitiveness and bolder than the others, dared to question Nature, to try to learn her softly-whispered secrets. S. P. Langley had placed over the door of the children's museum at the Smithsonian Institution: "Knowledge begins in wonder." And Mazzini, that Italian patriot and revolutionary of a century ago, agreed. "What would you have taught in schools?" asked some one of Mazzini. "One thing at any rate in all," replied Mazzini, " and that is some knowledge of astronomy. A man learns nothing if he hasn't learnt to wonder; and astronomy better than any other science teaches him something of the mystery and grandeur of the Universe. Now a man who feels this will soon feel something of his own greatness and mystery, and then for the first time he is a man."

It would be a magnificent thing if the first faltering steps taken in the art of discovering the universe could have been recorded. Then we should have the epitome of what the first investigator passed on to the second, what the second left for the third, and so on down the line. I suspect that this is a dream too fantastic to be entertained, and I cannot quite agree with the late Edwin B. Frost, who said,

> "I believe it would not be difficult to trace the development of this or other branches of learning in such a way that the lives of students should overlap, in point of time, back to the earliest beginnings of recorded history."

I must admit, however, that I can trace my own training in mathematics through six generations. I had as a teacher Anning (1883-), who was taught by Perrot, who was taught by Kummer (1810-1893) and Kronecker (1823-1891), who were taught by Dirichlet (1805-1859), who was taught by Gauss (1777-1855)!

To get back to our theme: Those whose wonder led to the questioning which gave rise to the thing we call science gave us more than mere knowledge. There were facts collected, to be sure, but those facts for a long time were not seen in their proper setting, and failed to be recognized in their proper relationship to man. Man knew the lightning, the flashing meteor, the flooding waters; he knew the imminence of drought, or blinding snow. These things he knew, but he knew not how or why they were. The forces of nature were not his companions; they were his enemies, or at best, his Nemesis, to be appeased. An astronomer, Harlan

True Stetson, in his "Man and the Stars," has put it well—this difference between then and now:

> "In ages past, the mystic raised
> His pillared temples toward the skies.
> In awe of all unknown, he cringed
> Before the elemental forces,
> Whose mysteries he scarce dared look upon,
> Save as deistic jealousies
> Appeased by sacrifice.
>
> Today man dedicates to truth
> The noblest temples mind can plan,
> Which rise with overarching domes
> To house huge telescopes, which scan
> The heavens to depths undreamed,
> And send the plummet to infinity;
> Exploring there to find at last
> A finite universe without an end . . ."

When unreasoning fear and awe become a questioning, a science is born. But for many centuries purely empirical fragments of observation were collected. Here and there, however, a greater mind wrestled with the problem of a system which would explain the phenomena which man had observed since the beginning of things. More and more closely these early philosophers approached the truth.

Forest Ray Moulton has said, "It is quite likely that a hundred thousand years from now historians will remember our period only because it was the one in which science first became a dominant factor in the progress of mankind. . . It is to the glory of astronomy that in it man started on the pathway to science. . . How interesting it is that . . . the supreme discovery of science—the orderliness of the universe . . . should have been discovered in the inaccessibly remote heavens before it was found in things near at hand. . . The very distances of the celestial bodies naturally made them objects of wonder. . . Such phenomena as the annual migrations of the sun, resulting in the seasons, and the progressions of the phases of the moon [occurred] frequently enough to be remembered and not so frequently as to become commonplace."

There is one statement in classical literature that is, to me, a masterpiece of naiveté. It is to be found in the 16th verse of the 1st chapter of the Book of Genesis: "And God made two great lights; the greater light to rule the day, and the lesser light to rule the night: he made the stars also."

"He made the stars also!" It is almost as an afterthought, it seems, for fear the reader might think the ancient writer did not know there were stars! What a pity that there are even today so many whose conception of a deity in creation is that of a worker of magic rather than the Spirit of order and purpose.

Those two great lights: Who hasn't heard of the debate over which is the more important, the sun or the moon? Augustus de Morgan print-

ed a bit of verse which puts it as well as can be expected; he called it "the Irishman's astronomy":

> "Long life to the moon, for a dear noble cratur,
> Which serves us for lamplight all night in the dark,
> While the sun only shines in the day, which by natur
> Wants no light at all, as ye all may remark."

Some there are who will say that it is a pity that the world has got so far beyond the point where such a statement as "he made the stars also" is complete and sufficient. Most of us have read Walt Whitman's verses, and many of us will agree with Edwin Markham, who called Whitman "a good poet but a bad philosopher." This is nowhere better illustrated than in the poem in which Whitman says this:

"When I heard the learn'd astronomer,
When the proofs, the figures, were ranged in columns before me,
When I was shown the charts and diagrams, to add, divide, and measure them,
When I sitting heard the astronomer where he lectured with much applause in the lecture-room,
How soon unaccountable I became tired and sick,
Till rising and gliding out I wander'd off by myself,
In the mystical moist night-air, and from time to time,
Look'd up in perfect silence at the stars."

Now no one appreciates more than I the simple kind of astronomy. I've recently written a book in which there are practically no facts and figures—only fancies and imagination. But I must believe that Whitman here displays a lack of depth of appreciation for beauty of a type about which he could have written some quite stirring lines. Note, as an example, what Alfred Noyes was able to do with the material of astronomy in his magnificent "Watchers of the Sky."

Again in pessimistic vein, we find this, from W. E. Henley:

> "The world, a world of prose,
> Full-crammed with facts, in science swathed and sheeted,
> Nods in a stertorous after-dinner doze!
> Plangent and sad, in every wind that blows
> Who will may hear the sorry words repeated:—
> 'The Gods are dead.'"

Yes, the gods are dead! With a little "g"; g-o-d-s. And it is to the everlasting glory of astronomy that it was a growing knowledge of the orderliness of the universe that laid the old gods low.

Let us go back to the 23d century B.C., to the days of the kings of Sumer and Akkad, when some forgotten astrologer set down the circumstances of an eclipse of the moon. By what impudence did he thus note the doings of the gods! Or, perhaps, by what divine command did he thus set down the figures which today enable us to derive one more decimal place in the period of the moon's motion! Of course, such observations were only occasionally set down. Not until the reign of the Babylonian Nabonassar was a continuous series of such observations begun. The record begins in 747 B.C., and extends through more than

3½ centuries uninterrupted—the longest series of observations man ever made.

There was a Chaldean astronomer named Nabu-Rimannu who used about 2½ centuries of these observations to calculate the length of the year as $365^d\ 6^h\ 15^m\ 41^s$ (about 6½ minutes too long, for the sidereal year). About 400 B.C., another Chaldean, Kidinnu, made better tables of the motions of the sun and moon, and gave a value of the eclipse year which was only 1 second too long. He discovered the difference between the tropical and the anomalistic year, and this is almost a discovery of the precession of the equinoxes.

Of these two gentlemen, the late James Henry Breasted, one of the foremost modern scholars of man's climb to civilization, has this to say: "These two remarkable Chaldeans, who first revealed to men a *system* of the celestial world, should be reverently remembered long after the kings and conquerors of the ancient world have been forgotten." But of another ancient astronomer Breasted has made an even stronger statement.

Thales of Miletus was a statesman, but he must have been interested in philosophy, for he received a list of the Babylonian observations, and deduced a means of prediction of eclipses. How good his method was we have no way of knowing today, but he must not have been overly confident for he told the people of Miletus only that they might expect an eclipse of the sun *before the end of a certain year*. This eclipse is believed to be the one of May 28, 585 B. C. When it occurred, the fame of Thales soon spread. Of this event, Breasted says this:

> "The prediction of an eclipse, a feat already accomplished by the Babylonians, was not so important as the *consequences* which followed in the mind of Thales. Hitherto men had believed that eclipses and all the other strange things that happened in the skies were caused by the momentary angry whim of some god. Now, however, Thales boldly proclaimed that the movements of the heavenly bodies were in accordance with fixed laws. *In the history of human thinking this was probably the most fundamentally important step ever taken.* The gods were thus banished from control of the sky-world where the eagle of Zeus had once ruled."

In the works of these ancient immortals we find illustrated one of the great lessons astronomy has for us: Faith in our intellectual ancestors and the value of coöperative effort. No man could in his life-time make enough observations, with the primitive instruments of 25 centuries ago, to determine the length of the year and the limping periodicity of eclipses. But the use of long series of observations by others enabled Kidinnu to derive these quantities, and made it possible for Thales to astound his fellow-citizens of Miletus. He took on faith the recorded observations of those in a foreign land, whose very names were unknown to him. For even then there must have been developing that wondrous sense of truth and love of fact that imbues all true scientists. There have been few scoundrels among scientists; there have been a few misguided arrogant ones who set styles of empiricism which today we

frown on, but practically no downright scoundrels. All have profited by what those before them have done, and all feel a responsibility to coming generations. Today we trust a Hubble to deliver to us the summarized knowledge derived by Humason and others from photographs made with the world's largest telescope; we can not all have the use of that instrument, to check for ourselves each step in every research project. We trust observers to yield us the proper observations, unbiased and undistorted. We trust the theorists to use these observations and the best powers of their minds to deliver to us at least a schematic picture of what the universe is like.

Sometimes, it is true, theory passes observation, and the extrapolation leads to a mistaken picture. But this is only because we sometimes are too demanding, insisting upon a picture of the whole before many parts have been perceived. Man's curiosity sometimes is too easily satisfied with a pat explanation too easily dreamed up. But I feel that it was unkind of Samuel Butler to say that man does not really wish to know; that all he desires is tranquillity of mind, or, as Butler wickedly put it, to have "the peace that passeth understanding."

Think of old Eratosthenes who, about 250 B.C., noted that at Alexandria, at the summer solstice, the sun stood a fiftieth of a circumference south of the zenith. He had heard that at Syene, a place almost directly south of Alexandria, the sun on the same day shone all the way to the bottom of a well. He used this observation of another, combined with his own, to deduce the fact that the distance between the two cities was one fiftieth of the circumference of the Earth. Then he used the measure of someone else for the distance btween the two cities—5000 stadia—to determine the circumference of the Earth as 250,000 stadia.

Think of old Hipparchus, a century after Eratosthenes, who adopted and extended the work of Aristillus and Timocharis, who had begun a catalogue of their measurements of star positions. He noted the differences in positions of the stars from the early measures to his own, and discovered the precession of the equinoxes. He made no charge that the early measures were wrong; already the faith in the other fellow's work was well established, and Hipparchus considered that the only explanation of the discrepancy was a slow increase in the longitudes of all the stars. He gave the value 36″ (instead of the proper 50″) per year for the change, but that does not influence our opinion of him.

Sometimes that erroneous value of the precessional constant does influence our opinion of Claudius Ptolemy, who lived and worked three centuries after Hipparchus. Many times Ptolemy has been accused of dishonesty because it looks as though his star catalogue is that of Hipparchus brought up through 300 years by means of the erroneous

value of the constant of precession.* Ptolemy was probably innocent of any intentional wrong; we know he made some observations, and he does not say that he made all of them. In fact he gives Hipparchus explicit credit for his discovery of precession. Perhaps the greatest censure Ptolemy deserves is to be directed at his having put astrology on such a firm footing that even today his precepts are followed by the fakers who pretend to read man's destiny among the stars. Incidentally, they read it among the stars as of 150 A.D., and not as of our time. The astrologers have not yet discovered precession.

After Ptolemy, dark hateful centuries came, when the lamp of learning was kept lighted only by a faithful few in monkish cells and Arabian tents and Moorish palaces. But at length there came a faint light of dawn, three centuries and more ago. Voice by voice the chorus of singers of the truth was swelled. Old systems in literature, in science, in art were overthrown; tradition ceased to bind men's minds. Again the spirit of investigation began to assert itself. The noblest power of man—the power to reason—began to free him from the miasma of the Dark Ages.

There was the Polish monk, Copernicus, who insisted on setting before the world the ideas which had first been suggested by Greek scholars and had since been disapproved by those who followed Ptolemy too blindly. There was the Danish nobleman, Tycho Brahe, who disgraced his high station by dabbling in alchemy and astronomy, and left a heritage of accuracy and good observations for Kepler to use in unravelling the intricacies of the Copernican system of cosmology.

We sometimes forget that Copernicus left his theory in pretty shabby condition. After all, he was not an astronomer so much as geometrician. He appealed to those who believed in Ptolemy's cycles and epicycles to put the center of the system at the sun, and then draw their deferents and epicycles. It was a cumbersome thing to try to explain in minute detail how the planets moved, as long as circles and combinations of circles were used. It was such a system that Alphonso the Wise was criticizing when he cried out to his tutor, "Had I been present at creation, I could have given some advice."

It was John Kepler, the German, who came to Tycho as a disciple in Prague, who put the system in order. His laws of planetary motions are too well known for me to dwell upon them here. He was particularly proud of his discovery of the third law, connecting the sizes of the planetary orbits with the periods of revolution of the planets. Of it he wrote:

> "What I prophesied two-and-twenty years ago . . . at length I have brought to light and recognized its truth beyond my most sanguine expectations. It is not 18 months since I got the first glimpse of light, three

*It has been demonstrated that, with the value of the length of the year used by Ptolemy, it was impossible with good observations to obtain any value other than 36″ for the precessional constant.

> months since the dawn, very few days since the unveiled sun burst upon me. Nothing holds me; I will indulge my sacred fury. . . The die is cast, the book is written, to be read now or by posterity, I care not which. It can await its reader; has not God waited 6000 years for an observer?"

It must be appreciated that Hipparchus and Copernicus, yes, and Kepler, too, were merely saying *how* things worked. And Galileo, in his discovery of the law of the pendulum, and in his primitive enunciation of laws which were later put in more beautiful form by Newton—he too was telling only *how* things worked. All popular lecturers in astronomy owe Galileo a debt of gratitude for one thing, at least. The uninitiated often asked the question, "Why do the planets keep revolving about the sun? What keeps them going?" This question reminds me of an experiment in art which has been conducted by certain Viennese psychologists, who permit children of various ages to express themselves in oils and other media. The result is almost invariably that the very young make likenesses which for all the world resemble the most primitive art left to us by the cave man and certain contemporary aboriginal types. The somewhat older children, say of ages 12-13, make likenesses which resemble those of the early Renaissance period. The older ones approach the almost photographic type of art. I am not sure what the experiment proves, but it is probably intended to show that the mind of the cave man was as that of a child, the mind of the early Renaissance was that of an adolescent, and now we are coming of age.

And so it must be in science, as well. Those who ask, "What keeps the Earth moving?" are as well advanced in science as the most able of the scholars of the 16th century. It is a pleasure to tell them of Galileo, who first inquired, as did a man who was urged to express wonder at the sight of Niagara Falls, "What's to stop it?" When Galileo put the idea in reverse, so to speak, it became less troublesome. He merely suggested that in our terrestrial observations something (friction) always made a ball stop rolling, and that if there were no friction the ball would keep on going. So the planets, in their motions, are not hindered, hence they continue without halting. It is surprising how quickly the concept is grasped by those who have never thought on it before.

I believe it was Lagrange who said that Newton was the greatest genius that ever lived, "and the most fortunate, for nobody ever again could be the first to set the world in order." With Newton, we come to the first explanation of *why* and not merely *how* things happen. It is true that Newton put a postulate which is justifiable only by its ends. The law of gravitation is proved only because it works, but at least Newton has reduced the assumptions to a minimum, and these few are applicable over a wide range of phenomena. I never cease delighting in the ease and beauty of the proof of Kepler's three laws of planetary motion, including a small correction for the masses, in the third law. The only assumptions that are made are these: Force is Mass times Acceleration; the Force is Gravitation, which varies directly as the

product of the Masses and inversely as the Separation. Then one proceeds, using that other invention of Newton, "fluxions," or the calculus.

Here I might interpolate something that bothers a great many of us. Why did Newton delay so long in enunciating his law of gravitation? The story is told that he used an erroneous value of the Earth's radius in his first attempts at numerical agreement between the fall, say, of an apple and the fall of the Moon toward the Earth. And we are told that at last Picard derived a new and more nearly correct value for the radius of the Earth, whereupon Newton started through the calculations once more, becoming so excited as he suspected its successful outcome that an assistant had to finish the computations. This is very pretty, but the truth is probably even more of a tribute to the greatness of that mighty intellect. Newton felt intuitively that two spherical masses, as the Earth and the Moon, should attract each other as though all the masses were concentrated at their respective centers. But he would not utter his conclusions until he had proved it. Prove it he did, and immediately thereafter he set down his law for all to see.

Newton himself very beautifully acknowledged his indebtedness to his scientific ancestors, when he said, "If I have been able to see further than other men, it is because I have been standing on the shoulders of giants." Newton appreciated, too, the vast world remaining to be explored: "I know not what the world will think of my labors, but to myself it seems that I have been but as small child playing on the sea shore; now finding some pebble rather more polished, and now some shell rather more variegated than another, while the immense ocean of truth extended itself unexplored before me."

This feeling of Newton that all had not come to a glorious culmination with his work is perhaps what Sir Edwin Arnold meant when he penned the lines in "The Light of Asia":

> "Shall any gazer see with mortal eyes
> Or any searcher know by mortal mind?
> Veil after veil will lift—but there must be
> Veil after veil behind."

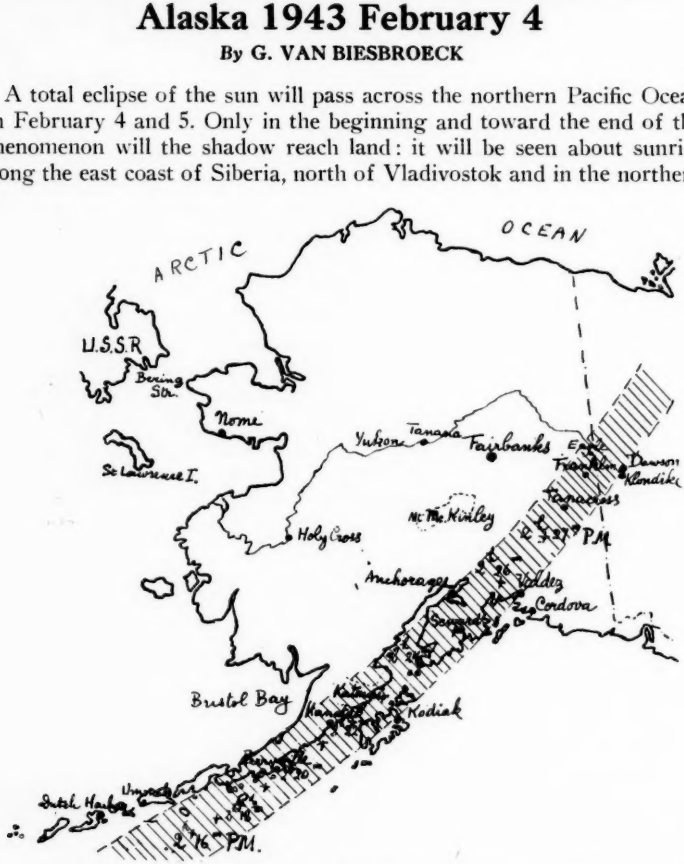
During his lifetime, there were those who tried to stir up controversy over the rightful claimant to the discovery of the calculus. The continental aspirant was Leibnitz, who paid one of the finest tributes to Newton, and in so doing left the field clear for the Englishmen: "Taking mathematics from the beginning of the world to the time of Newton, what he had done was much the better half."

(To be continued)

The Total Eclipse of the Sun Visible in Alaska 1943 February 4

By G. VAN BIESBROECK

A total eclipse of the sun will pass across the northern Pacific Ocean on February 4 and 5. Only in the beginning and toward the end of the phenomenon will the shadow reach land: it will be seen about sunrise along the east coast of Siberia, north of Vladivostok and in the northern



Map of Eclipse Path in Alaska on February 4, 1943

island Hokkaido of the Japanese Archipelago. The middle of the eclipse occurs near the international date line and not until sunset does the shadow strike land again, this time across the middle of Alaska. The zone of totality has been plotted on the map as a shaded area from the data furnished by the "Nautical Almanac." Through Alaska it is about one hundred miles wide and for points near the central line totality will last about two minutes. It will be seen that Dutch Harbor is some sixty miles north of the zone of totality, that the zone covers the north-

western half of Kodiak Island, passes over the towns of Seward, Anchorage, and Valdez, and terminates a little beyond Klondike and Dawson in Canada, where totality coincides with sunset. The times of occurrence of the middle of the eclipse can be estimated from the hours marked along the central line in Alaska Standard Time.

Outside of the shaded zone many localities will have the opportunity of seeing a partial eclipse; the part of the sun that is covered by the moon decreasing with distance away from the central line. At Fairbanks, for instance, 97% of the sun's diameter will be covered at $2^h\ 34^m$ P.M. At Juneau ($2^h\ 38^m$ P.M.) the corresponding figure is 88%, while at Nome ($2^h\ 9^m$ P.M.) the amount is 89%. The Aleutian Islands are north of the central line and the partial phase will be seen there in the early afternoon; about three quarters of the sun's disk will be covered for most points along that chain of islands. On the south side of the zone of totality the beginning of the partial phase will be seen shortly before sunset all along the Pacific Coast as far south as the Mexican border and as far inland as Salt Lake City but for this whole area the middle of the eclipse is not reached until after sunset.

YERKES OBSERVATORY, WILLIAMS BAY, WISCONSIN.

Around the Year 1943 with Sun, Moon, and Planets

By ALICE H. FARNSWORTH

NOTE: Unless otherwise indicated, times are recorded in Greenwich Civil Time (Universal Time), counted from midnight (0^h) through 24 hours. Subtract 5 hours to obtain Eastern Standard Time, 6 hours for Central, etc. Thus February 2, 3^h G.C.T. is February 1, 21^h (9 P.M.) C.S.T. Most of the data have been taken from *The American Ephemeris and Nautical Almanac*. Certain statements about occultations of bright stars were taken from The Observer's Page in the December (1942) number of *Sky and Telescope*.

ECLIPSES

The eclipse seasons this year occur in February and August. Twice annually the Sun (Earth's shadow)* in its apparent eastward journey around the sky comes near to one of the points, called nodes, where the Moon's path intersects the Sun's path. Therefore twice every year for a period of about 30 days the Sun (Moon) is in a position to be eclipsed on the date of New (Full) Moon. Since the Moon is new (full) every 29½ days, it is evident that in each critical period of 30 days the Moon is bound to be new (full) once, and may be new (full) twice. Thus either one or two solar (lunar) eclipses will occur in each season.

In 1943 the first critical period covers the entire month of February when the Sun (Earth's shadow) is in the vicinity of the descending (ascending) node. Since New (Full) Moon does not occur until February 4 (20) only one solar

*Please note that the remarks in these paragraphs apply to solar eclipses if read *without* the words in parentheses. With the parenthetical words substituted they apply to lunar eclipses. In each case both umbral and penumbral phenomena are taken into consideration.

eclipse, a total, and one lunar eclipse, a partial, will occur during this February season.

Somewhat similar conditions obtain in the summer of 1943, when the Sun is near the opposite or ascending node. The critical period lasts from July 24 to August 25 with New (Full) Moon occurring only once during this period, on August 1 (15). During the solar eclipse on this occasion the moon's true shadow cone fails to reach the earth at any point, but observers in the cone produced will see an annular eclipse, *i.e.*, during the moments of greatest obscuration of the Sun by the Moon, a ring of bright sunlight will remain encircling the dark Moon.

During 1943 we have, then, in February a total eclipse of the Sun followed in a fortnight by a partial eclipse of the Moon; and in August an annular eclipse of the Sun followed by a partial eclipse of the Moon. The details given below, and the maps, are taken from *The American Ephemeris and Nautical Almanac.*

I. A total eclipse of the Sun will occur on February 4-5, 1943. The path of totality (see Figure 1) starts at sunrise in Manchuria, cuts across Japanese Hokkaido, across the Pacific Ocean to reach land again at the Alaska Peninsula and Kodiak Island, and ends at sunset in the Yukon, half a degree beyond the Arctic Circle. The greatest duration of totality, on the central line in mid-Pacific, is $2^m\ 39^s$, the Moon's diameter exceeding the Sun's by 47″. The eastern coast of Asia generally will see a partial eclipse early in the morning. On the western coast of North America a partial eclipse will be in progress at sunset. The

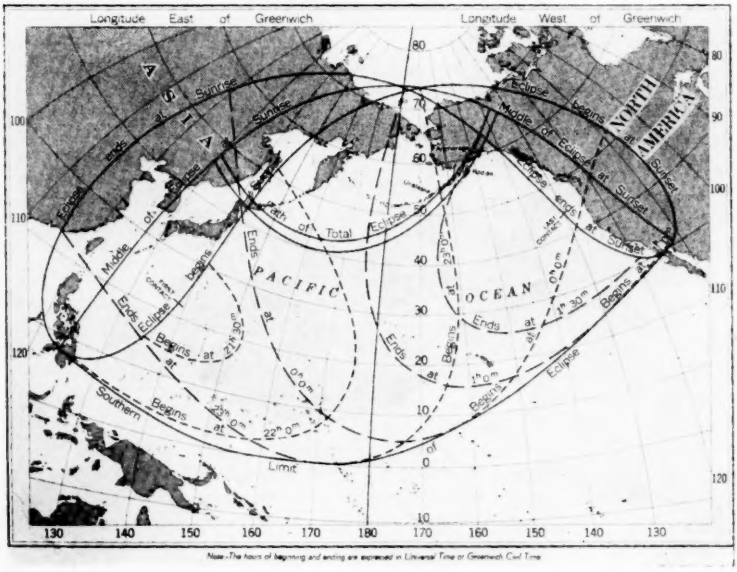


FIGURE 1
TOTAL SOLAR ECLIPSE OF FEBRUARY 4-5, 1943

southern limit of the eclipse grazes the equator, northeast of the Solomons.

CIRCUMSTANCES OF THE ECLIPSE

	G.C.T. d h m
Eclipse begins	February 4 21 26.3
Central eclipse begins	4 22 47.6
Central eclipse at local app. noon	4 23 56.3
Central eclipse ends	5 0 27.7
Eclipse ends	5 1 49.1

II. A partial eclipse of the Moon will occur on February 20, 1943. The beginning will be visible generally in Europe, Africa except the eastern part, the Atlantic Ocean, North and South America, and the eastern part of the Pacific Ocean. The ending will be visible in western Europe, the extreme northwestern part of Africa, the North Atlantic and western part of the South Atlantic Ocean, North and South America, the eastern and central part of the Pacific Ocean, and the northeastern extremity of Asia.

CIRCUMSTANCES OF THE ECLIPSE

	G.C.T. d h m
Moon enters penumbra	February 20 2 43.1
Moon enters umbra	20 4 3.0
Middle of the eclipse	20 5 38.0
Moon leaves umbra	20 7 13.0
Moon leaves penumbra	20 8 32.4

Magnitude of the eclipse = 0.767 (Moon's diameter = 1.0)

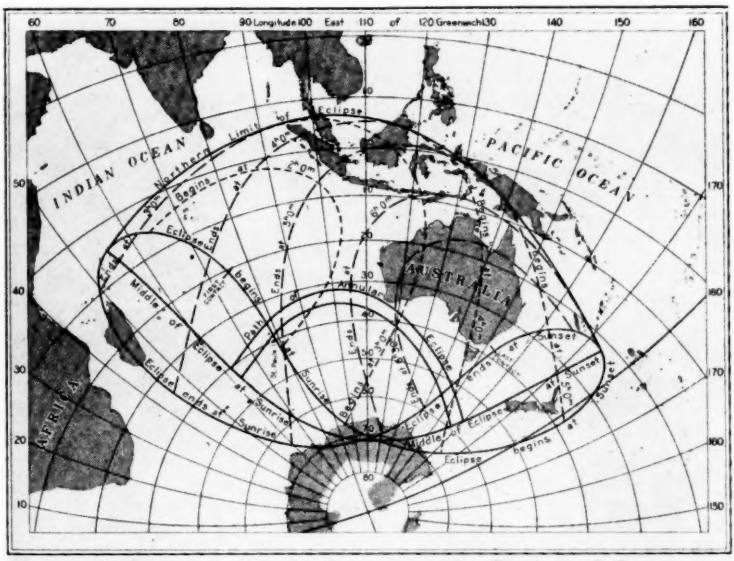


FIGURE 2
ANNULAR ECLIPSE OF AUGUST 1, 1943

The umbra first touches the Moon's limb 140° east of the north point, and leaves it finally 110° west of the north point.

III. An annular eclipse of the Sun will occur on August 1, 1943, visible along a path in the ocean south of Australia. The region which will see the eclipse as partial extends from Madagascar at sunrise to New Zealand at sunset, and from the East Indies southward to Antarctica, (see Figure 2). The Moon, being in apogee on this date, its angular diameter is unusually small and it fails to cover the Sun. The Sun's diameter exceeds the Moon's by more than 2′ and the maximum duration of the annular phase on the central line of the path is $6^m\ 59^s$.

CIRCUMSTANCES OF THE ECLIPSE

	G.C.T. d h m
Eclipse begins	August 1 1 36.4
Central eclipse begins	1 3 5.6
Central eclipse at local app. noon	1 4 31.4
Central eclipse ends	1 5 25.9
Eclipse ends	1 6 55.1

IV. A partial eclipse of the Moon will occur on August 15, 1943. The beginning will be visible generally in the western part of the Pacific Ocean, Antarctica, Australia, and New Zealand, the Indian Ocean, Asia, southwestern Europe, and Africa except the northwestern part. The ending will be visible generally in Asia except the northeastern part, Australia except the extreme eastern part, Antarctica, the Indian Ocean, Europe, Africa, the eastern extremity of South America, and the eastern and southern parts of the Atlantic Ocean.

CIRCUMSTANCES OF THE ECLIPSE

	G.C.T. d h m
Moon enters penumbra	August 15 16 58.0
Moon enters umbra	15 17 58.5
Middle of the eclipse	15 19 28.4
Moon leaves umbra	15 20 58.1
Moon leaves penumbra	15 21 58.3

Magnitude of the eclipse = 0.876 (Moon's diameter = 1.0)

The umbra first touches the Moon's limb 44° east of the north point, and leaves it finally 71° west of the north point.

THE BRIGHT PLANETS

The accompanying table (page 33) is designed to aid in identifying and locating the five bright planets. It is useful in two ways. The coördinates, right ascension and declination, (somewhat analogous to longitude and latitude on the earth's surface) are given for each object on the first of each month. The student has only to plot the planet upon its stellar background on any star map provided with hour circles (the meridians of the sky) and parallels of declination. It thus becomes apparent in what constellation the planet will be found. As the table indicates, Mercury, Venus, and Mars are distinctly temporary interlopers in any one constellation; Jupiter remains for about a year and Saturn for two or three years.

The table provides another method of identifying a planet seen perhaps in the twilight glow before the sky is dark enough to reveal the surrounding stars. Note by how many hours the right ascension of the object differs from that of

Right Ascensions and Declinations of the Sun and Brighter Planets in 1943

		—Sun—	—Mercury—	—Venus—	—Mars—	—Jupiter—	—Saturn—
Jan. 1	α	18h 42m2	19h 56m2	19h 30m2	16h 39m7	7h 33m4	4h 21m0
	δ	−23° 5′6	−22° 42′5	−22° 57′9	−22° 15′9	+21° 58′5	+19° 36′0
Feb. 1	α	20h 54m8	19h 50m8	22h 8m8	18h 16m5	7h 16m3	4h 16m1
	δ	−17° 24′3	−17° 35′5	−13° 4′4	−23° 51′2	+22° 37′2	+19° 31′5
Mar. 1	α	22h 44m4	21h 11m9	0h 17m4	19h 45m8	7h 6m9	4h 17m9
	δ	− 7° 59′9	−17° 31′5	+ 0° 48′8	−22° 2′7	+22° 55′4	+19° 43′4
Apr. 1	α	0h 38m2	0h 27m6	2h 38m5	21h 21m7	7h 8m8	4h 26m5
	δ	+ 4° 6′9	+ 1° 25′6	+15° 53′8	−16° 42′4	+22° 53′9	+20° 10′8
May 1	α	2h 29m4	3h 50m2	5h 6m5	22h 49m4	7h 21m9	4h 39m7
	δ	+14° 44′3	+22° 51′4	+24° 44′9	− 9° 9′3	+22° 31′4	+20° 43′7
June 1	α	4h 31m9	3h 44m5	7h 41m0	0h 15m4	7h 43m7	4h 56m1
	δ	+21° 54′0	+16° 19′1	+23° 54′8	− 0° 16′7	+21° 44′6	+21° 15′8
July 1	α	6h 36m1	5h 17m8	9h 45m7	1h 35m9	8h 9m2	5h 12m6
	δ	+23° 11′1	+21° 48′7	+14° 47′1	+ 7° 59′2	+20° 35′8	+21° 39′7
Aug. 1	α	8h 41m2	9h 40m4	11h 7m2	2h 56m6	8h 37m3	5h 28m1
	δ	+18° 18′1	+15° 32′9	+ 2° 39′9	+14° 58′2	+19° 3′1	+21° 54′5
Sept. 1	α	10h 37m5	12h 12m8	10h 53m8	4h 10m7	9h 4m7	5h 39m7
	δ	+ 8° 41′2	− 4° 20′2	− 2° 2′1	+19° 38′4	+17° 6′8	+22° 0′6
Oct. 1	α	12h 25m5	11h 41m8	10h 17m8	5h 5m8	9h 28m4	5h 45m2
	δ	− 2° 45′4	+ 1° 10′5	+ 4° 40′8	+22° 6′3	+15° 33′9	+22° 0′9
Nov. 1	α	14h 21m3	13h 59m6	11h 30m3	5h 25m6	9h 47m2	5h 43m5
	δ	−14° 4′7	−11° 4′0	+ 2° 52′2	+23° 36′9	+14° 6′4	+21° 58′5
Dec. 1	α	16h 24m6	17h 12m5	13h 24m2	4h 52m2	9h 57m2	5h 35m7
	δ	−21° 38′0	−24° 56′3	− 6° 32′0	+24° 25′6	+13° 21′4	+21° 54′6

the Sun on the same date. If the planet's right ascension is somewhat greater it lies east of the Sun, the Sun will set ahead of the planet, and the planet will be best seen in the western sky after sunset. Objects west of the Sun, with smaller right ascension, will rise before the Sun and be visible in the early morning hours. If the difference in position is in the neighborhood of twelve hours, the planet will be in the east at sunset. The Sun's positions are approximately repeated year after year and will be found to lie on the ecliptic, a circle which is printed on many star maps.

At present two bright planets help to form the magnificent jeweled oval due south in the evening sky. Trace it from Capella near the zenith southward through β Aurigae, Castor and Pollux, Jupiter, Procyon, to Sirius and its neighbor γ and β Canis Majoris; then back through Rigel, Aldebaran, and Saturn. The Moon will be found midway of its path through the oval on January 18 (nearly full), February 14 (gibbous), March 14 and April 10 (near First Quarter), and May 7 (crescent). Next fall Mars will join the group, making up for the loss of Jupiter which will have strayed away eastward.

The motions of Mars and Saturn in Taurus, described below under the calendar item for date October 9, are depicted in Figure 3 for the latter part of 1943.

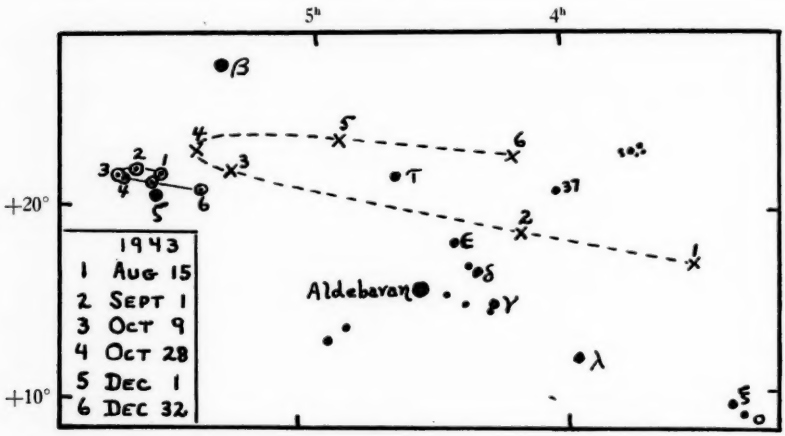


FIGURE 3

Paths of Mars (×) and Saturn (⊙) through Taurus in the fall of 1943. The key in the lower left corner shows the date when each planet is to be found in the position indicated by the appended number. Saturn is stationary on October 9, Mars on October 28.

THE FAINTER PLANETS

Uranus in 1943 continues its path through the constellation Taurus as shown in Figure 4. An opera-glass should easily show all stars indicated on the chart and distinguish Uranus passing among them. The planet comes to opposition at the end of the year when it moves back into a configuration of stars which might almost be called the "false Pleiades," northeast of ϵ Tauri. The planet's brightness

(magnitude 5.9) will be similar to that of the two southernmost stars of the group.

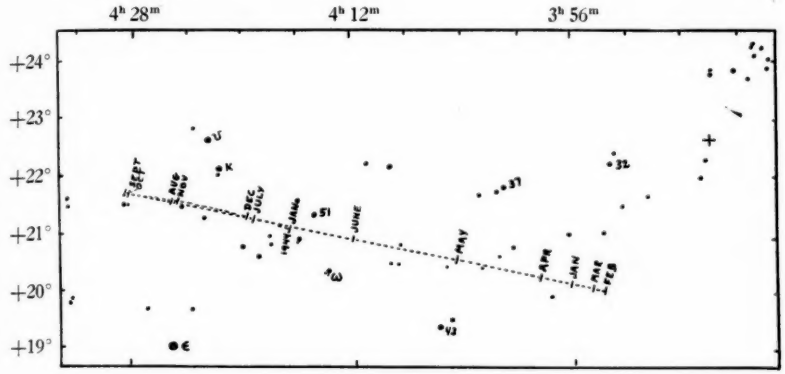


FIGURE 4

The path of Uranus during 1943 in Taurus between the Pleiades and ε Tauri in the Hyades. The planet's position is indicated on the first day of each month including January 1, 1944, and at the stationary point on September 14. The position reached by Mercury at its greatest elongation east on April 30 is shown by +. Mars' passage through this region is plotted in Figure 3.

Neptune, whose leisurely progress backward and forward in Virgo just northeast of the autumnal equinox is plotted in Figure 5, requires a telescope for observation. At opposition in March it will be close to the star (B.D. +1° 2656) which it resembles in brightness, shown at R.A. 12h 05m on the chart. At the end of the year (December 11) it passes extremely close to η Virginis.

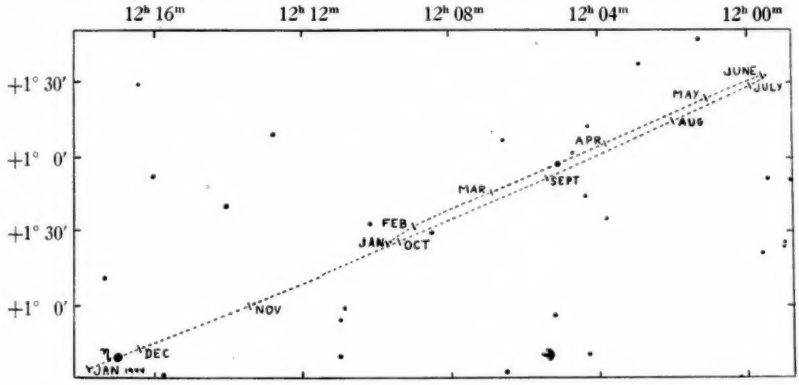


FIGURE 5

The path of Neptune for 1943 in Virgo, near the star η Virginis. Positions are indicated on the first of each month.

Pluto, faint outpost of the solar system as we know it, is in the constellation Cancer, having moved eastward about 19° in the thirteen years since its discovery near δ Geminorum in 1930. It is interesting to note that Jupiter passed by Pluto near the end of that year, and now in the beginning of 1943 passes it again after making a complete circuit of the ecliptic.

Planetary Calendar

Current happenings among the planets will be indicated each month, as in previous years. A brief preview of some of the more conspicuous events is presented now in the form of a calendar with comments.

As in the case of a solar eclipse, the occultation of a star or planet by the Moon is a phenomenon visible only in a limited track on the earth's surface. Therefore for some observers an occultation listed in the calendar may appear only as a close approach; for some it will be invisible because the objects are not above the horizon at the time. Detailed predictions for three widely-distributed stations in the United States are printed in Popular Astronomy each month usually in the pages immediately following the notes on planets. In general unless otherwise noted, the occultation of the planet, visible as such from some terrestrial region but not from any of the stations named, is listed as a close conjunction.

An asterisk has been added to each Greenwich date where the phenomenon occurs on the previous date as seen from the United States. For example the occultation of Aldebaran is to be expected on the evening of Saturday, January 16. Events occurring after midnight belong to the new date.

Calendar for 1943

Jan. 2 Earth is at perihelion.

Jan. 11 Jupiter is at opposition with Sun (magnitude —2.2).

Jan. 17* Moon occults Aldebaran.
This is the 31st in a series of 43 occultations of Aldebaran visible from the Earth (between the parallels of latitude of 50° N and 50° S) in successive revolutions of the Moon extending from August, 1940, to December, 1943. Only those dates are given here on which the occultation is listed as visible from one of the stations referred to above.

Feb. 4 Total solar eclipse in north Pacific Ocean.

Feb. 10 Surface features on Moon's west limb well visible.

Feb. 18 Mercury (morning star) at greatest elongation west of Sun (unfavorable).

Feb. 20* Partial lunar eclipse. Uranus 90° east of Sun.
The moon occults Regulus shortly before passing into the Earth's shadow. The phenomenon is visible only from the tropics.

Feb. 25 Saturn (evening star) 90° east of Sun.

Mar. 21 Sun reaches Vernal Equinox; spring begins at 6:03 A.M., C.S.T.

Mar. 22 Neptune (magnitude 7.7) is in opposition with the Sun.

Apr. 6 Jupiter (evening star) 90° east of Sun.

Apr. 9* Moon occults Aldebaran.

Apr. 25* Venus passes 3° north of Saturn. Easter Sunday (latest possible date).

Apr. 29 Close conjunction of Mars and Moon.

Apr. 30 Mercury (evening star, mag. 0.4) at greatest elongation east of Sun (favorable).

This is the best opportunity of the year to see Mercury in the evening sky. For several days before this date it will be visible in the twilight, farther north and somewhat lower than Aldebaran, appearing higher each night until it reaches a point within half a degree of the Pleiades. (See Figure 4.)

May 13* Moon occults Regulus.
Regulus is seen occulted from some portion of the Earth each time the Moon passes it between the dates July, 1942, and October, 1943. This occultation only is listed as practically observable this year from the United States.

May 26 Uranus is in conjunction with the Sun.

June 1 Venus passes 2° north of Jupiter.
Though Venus does not reach its greatest distance east of the Sun until the end of the month, its altitude in the western sky after sunset is considerably greater now than then. This is true because it moves during the month rapidly south as well as east.

June 7 Saturn is in conjunction with the Sun.

June 18 Mercury (morning star) reaches greatest elongation west of the Sun.

June 21 Neptune 90° east of Sun.

June 22 Sun reaches Summer Solstice; summer begins at 1:13 A.M., C.S.T.

June 28* Venus (evening star) reaches greatest elongation east of the Sun.
The telescope shows Venus in quarter phase with apparent diameter 24" on this date. It changes gradually to a thinner and thinner crescent, while the apparent diameter increases 2½ times until the date of inferior conjunction (Sept. 6). During this period the horns of the crescent turn toward the east, away from the Sun.

July 4 Earth is at aphelion.

July 5 Saturn's rings wide open.
The variation in width during the rest of the year as compared with this date, when the planet will still be too low in the east before sunrise for telescopic view, is very slight. Since 1936 when the rings were edgewise to the earth, the observer at the telescope has looked down upon the south side (inverted image) of the gradually widening rings. On this account the satellites appear to move in a clockwise direction around the planet. The view now is similar to that last obtained in 1914. During the 29.5-year interval the planet has moved once around the Sun.

July 6 Moon occults Venus (in daylight). Close conjunction of Venus and Regulus. Close conjunction of Regulus and Moon.

July 30 Jupiter is in conjunction with Sun.

July 31 Venus (magnitude —4.2) at greatest brilliancy, east of Sun.

Aug. 1 Annular solar eclipse in south Indian Ocean.

Aug. 15 Partial lunar eclipse.

Aug. 23 Moon occults Aldebaran.

Aug. 24* Mars (morning star) 90° west of Sun.

Aug. 28 Moon occults Jupiter (southern hemisphere).
Jupiter is occulted this year each time the Moon passes by, in the five months from August to December. This first of the series is visible from New Zealand. Only the October occultation is seen from the United States.

Aug. 29 Mercury (evening star) is at greatest elongation east of Sun.

Aug. 30 Second New Moon in August.

Sept. 2* Uranus 90° west of Sun.

Sept. 6* Venus is at inferior conjunction with Sun.

On this date the cusps of the thin crescent turn southward (away from the Sun) as it passes 8° south of the Sun. Hereafter the horns of the waxing crescent turn westward.

Sept. 20* Saturn (morning star) 90° west of Sun.

Sept. 23 Sun reaches Autumnal Equinox; autumn begins at 4:12 P.M., C.S.T.

Sept. 25 Neptune is in conjunction with the Sun. Close conjunction of Jupiter and Moon.

Oct. 9 Saturn starts moving westward in Taurus. (Figure 3.)
In October Taurus is once again the theatre of planetary movies. Observers recall that in the spring of 1942 Mars, Jupiter, and Saturn were three participants. This time Mars and Saturn seem to play a game. Mars comes charging down upon Saturn, overtaking it from the west; before reaching it Mars slows down appreciably whereupon Saturn turns and starts slowly chasing Mars (Oct. 9), whereat Mars soon turns and goes the other way (Oct. 28). They do not succeed in getting together; the end of the year finds them both still moving westward.

Oct. 10 Mercury (morning star) is at greatest elongation west of Sun (favorable).

Oct. 13* Venus at greatest brilliancy, west of Sun.

Oct. 17* Moon occults Aldebaran.

Oct. 18* Moon passes south of Mars and Saturn.

Oct. 23 Moon occults Jupiter.

Oct. 28* Mars stops moving eastward in Taurus.

Nov. 16 Venus (morning star) is at greatest elongation west of Sun.

Nov. 19 Jupiter (morning star) 90° west of Sun. Close conjunction of Jupiter and Moon.

Nov. 28 Mars nearest the Earth (distance 50 million miles).
Ruddy Mars at its closest approach to the earth in 1943 will be as bright as white Sirius (magnitude —1.6) seen 40° farther south in the sky at the same time. Its 4200-mile diameter will appear in the telescope to cover an angle of 17″ (the maximum possible is 25″) at this only moderately favorable opposition. This is about the size that Venus (diameter 7700 miles) appears forty days before greatest elongation east, and about half the angular diameter of Jupiter when it is near eastern quadrature. Northern observers are favored by the northerly declination of Mars at this time.

Nov. 29 Uranus (magnitude 5.9) is in opposition with Sun.

Dec. 5 Mars (magnitude —1.7) is in opposition with Sun. Saturn 0°.8 north of ζ Tauri. (Figure 3.)

Dec. 11 Neptune and η Virginis extremely close together. (Figure 5.)

Dec. 16* Saturn (magnitude —0.3) is in opposition with Sun.
This opposition is a favorable one for observers in the northern hemisphere since it occurs when the planet is near its maximum distance north of the celestial equator. The wide-open rings add half a magnitude to the total brightness of the planet. The orbits of the satellites, being near the plane of the rings, are tipped at so great an angle to the line of sight from the earth that all the moons pass above and below the planet; no eclipses, occultations, or transits are occurring.

Dec. 17 Close conjunction of Jupiter and Moon (visible as an occultation in Great Britain).

Dec. 22 Sun reaches Winter Solstice; winter begins at 11:30 A.M., C.S.T.

Dec. 23* Mercury (evening star) is at greatest elongation east of Sun.

Dec. 26 Neptune 90° west of Sun.

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The Planets in February, 1943

By ALICE H. FARNSWORTH

NOTE: Greenwich Civil Time is used unless otherwise stated. To obtain Eastern Standard Time subtract 5 hours; Central Standard Time, 6 hours, etc. Phenomena are described as seen from latitude 45° N. *The American Ephemeris and Nautical Almanac* is the source of most of the data.

Eclipses. Two eclipses occur this month. See pages 30, 31 for details and maps.

Sun. Positions for February 1 and March 1 are given in the table on page 33. In the constellation Capricornus when eclipsed on February 4, the Sun enters Aquarius on the 16th.

This is the season when the disk turned earthward by the Sun excludes its north pole and reaches beyond its south pole by 6 or 7 degrees. As a result, those who follow the paths of the sun-spot groups across the disk find them convex upwards. A spot 6° north of the solar equator appears 12° north of the Sun's center when it crosses the central meridian.

In view of the total eclipse this month it is worth recalling that 5.4 years have elapsed since the last spot maximum and that the corona may be expected to exhibit a shape more nearly "rectangular" than the "sun-flower" of the Canton Island-Peru eclipse of 1937 or the "intermediate" form of the Calvinia (South Africa) photographs of 1940. Possibly the aspect of long streamers seen in Maine in 1932 is as near as we can predict. The position of disturbed areas with relation to the Sun's limb on the date will determine the particular coronal pattern observed; the longest streamers will appear over prominences.

Moon. The Moon is nearest the earth on February 4 at 0^h (less than a day before it covers the Sun) and farthest away on the 16th at 8^h. The much foreshortened maria close to the west limb show best on the 6-day crescent, the north polar region bordering Mare Frigoris immediately after First Quarter. The phases occur as follows:

		h	m
New Moon	February 4	23	29
First Quarter	12	0	40
Full Moon	20	5	45
Last Quarter	27	18	22

Mercury. The best chance to see Mercury this month will be from the total eclipse track on February 4, when it will lie 22° west and slightly south of the Sun. Two weeks later, when it reaches greatest elongation (26°.4) west of the Sun, it will rise only about an hour before the Sun and be very inconspicuous at a low altitude.

Venus. Visible as evening star in the west after sunset, Venus is moving rapidly northward and by the end of the month will be due west at its setting, more than 2^h after the Sun.

Mars. Mars spends the month in Sagittarius, west of the Sun, rising about two hours before it but remaining low in the southeast.

Jupiter. The planet is a brilliant object in the evening sky, still moving westward in Gemini, southwest of Castor and Pollux.

On the same date (February 4-5) when the Earth's one Moon casts its shadow on the Earth, thus producing a total eclipse of the Sun, observers on Earth can

watch with a telescope three total solar eclipses in progress on Jupiter.

	Enters disk at h m	Leaves disk at h m
Shadow of Sat. IV	20 41	0 19
Satellite II	3 25	6 17
Shadow of Sat. II	4 40	7 31
Satellite I	4 55	7 10
Shadow of Sat. I	5 31	7 46

Thus between $5^h 31^m$ and $6^h 17^m$ (G.C.T.) two moons and their shadows are all in transit; the latter are easier to see. The entrances take place on the east side of the planet. On this night Satellite III will be seen well east of the planet.

On the night of February 12-13 a fine sequence of phenomena *behind* the planet occurs:

h	m	
21	45	Sat. IV disappears behind Jupiter (west limb)
1	17	Sat. IV reappears from behind Jupiter (east limb)
3	52	Sat. I disappears behind Jupiter (west limb)
5	02	Sat. IV disappears into Jupiter's shadow (east of planet)
6	56	Sat. I reappears from Jupiter's shadow (slightly east of planet)
8	47	Sat. IV reappears from Jupiter's shadow (east of planet)

Thus the fourth satellite is visible for 3¼ hours between its reappearance from occultation by the planet and its disappearance into eclipse within the planet's shadow.

Saturn. Saturn, in Taurus, ceases its westward motion on February 6 at a point on a line between Aldebaran and the Pleiades and starts to move eastward. On the 25th it reaches eastern quadrature, remaining in fine position for telescopic observation of its wide-open rings.

Uranus. This planet (magnitude 5.9) likewise reaches a stationary point in Taurus (on February 8) and on the 20th is in eastern quadrature. With the help of the chart (page 35) Uranus may be identified with either an opera-glass or small telescope. Its telltale motion among the "fixed" stars is very slow this month. Remember that Herschel discovered it from the appearance of its image in the field of his six-inch telescope.

Neptune. Neptune (magnitude 7.7) is now well started on its 5-month arc of retrogression in Virgo, close to the star η. See chart, page 35.

The right ascension and declination of each of the five bright planets at the beginning and end of the month are given in the table on page 33.

Occultation Predictions for February, 1943

(Taken from the *American Ephemeris*)

The quantities in the columns *a* and *b* are given for the purpose of making these predictions useful for any place within 200 miles of the point indicated. The procedure is as follows: Subtract the longitude of the point given from the longitude of the place in question; multiply the result in degrees, taking the signs into account, by the quantity under *a* for the star to be observed; similarly, with the latitude, using *b*; apply the sum of the products, with its proper sign, to the Greenwich C.T., and obtain the predicted Greenwich Civil Time for the phenomenon at the place of observation. To obtain Eastern Standard Time it is necessary to subtract five hours; Central Standard Time, six hours, etc.

Date 1943	Star	Mag.	IMMERSION Greenwich C.T.	IMMERSION a	IMMERSION b	IMMERSION Angle E from N	EMERSION Greenwich C.T.	EMERSION a	EMERSION b	EMERSION Angle E from N
			h m	m	m	°	h m	m	m	°
	OCCULTATIONS VISIBLE IN LONGITUDE +72° 30′, LATITUDE +42° 30′									
Feb. 11	8 B.Tau	6.2	21 27.4	—1.9	+1.1	80	22 52.0	—1.7	+1.4	234
12	BD+12° 477	6.2	0 0.6	..	..	136	0 39.3	..	..	188
12	48 Tau	6.4	22 44.2	—2.5	—0.6	109	23 56.8	—1.6	+2.4	216
13	γ Tau	3.9	1 44.1	—1.7	—2.5	119	2 47.8	—1.5	+1.1	220
13	70 Tau	6.4	5 8.1	—0.2	—1.2	88	6 8.5	+0.1	—1.1	262
17	d^2 Cnc	6.2	22 25.5	+0.3	+4.4	33	22 59.0	—1.4	—1.9	334
21	χ Leo	4.7	6 51.3	..	..	56	7 31.6	..	..	358
23	BD—0° 2603	6.1	8 41.4	—1.0	—2.4	154	9 45.0	—1.9	—0.9	261
	OCCULTATIONS VISIBLE IN LONGITUDE +91° 0′, LATITUDE +40° 0′									
Feb. 11	μ Cet	4.4	4 10.3	—0.5	—1.4	95	5 10.0	—0.2	—0.3	237
11	BD+12° 477	6.2	23 9.8	—3.0	—1.1	116	0 9.3	—1.1	+3.6	199
12	48 Tau	6.4	22 4.8	—1.7	+1.1	92	23 21.9	—1.4	+2.2	228
13	γ Tau	3.9	1 6.9	—2.7	—2.1	120	2 12.4	—1.7	+2.8	210
13	70 Tau	6.4	5 3.6	—0.7	—1.9	108	6 6.7	—0.6	—0.4	240
13	θ^1 Tau	4.0	6 41.9	+0.1	—2.1	120	7 31.1	—0.1	—.01	231
13	θ^2 Tau	3.6	6 58.4	..	..	155	7 18.9	..	..	196
21	χ Leo	4.7	6 0.8	—2.2	+0.2	96	7 22.5	—1.5	—2.0	317
	OCCULTATIONS VISIBLE IN LONGITUDE +120° 0′, LATITUDE +36° 0′									
Feb. 11	μ Cet	4.4	3 42.8	—1.9	—1.8	107	4 48.1	—1.2	+1.3	216
12	f Tau	4.3	0 52.0	..	..	135	1 25.4	..	..	178
12	γ Tau	3.9	23 56.5	—1.8	+1.0	94	1 13.4	—1.4	+2.4	225
13	70 Tau	6.4	4 33.3	..	..	134	5 25.6	..	..	205
13	75 Tau	5.3	6 25.3	—1.4	+0.2	57	7 31.2	—0.5	—2.2	291
13	264 B.Tau	4.8	7 36.6	—0.5	—1.8	108	8 37.6	—0.4	—0.4	243
15	19 B.Gem	6.2	9 16.2	—0.3	—1.9	117	10 16.2	—0.3	—0.8	253
21	χ Leo	4.7	5 15.5	—1.1	—0.4	129	6 29.9	—1.7	+0.9	272
24	80 Vir	5.8	8 27.7	—2.0	+2.0	75	9 23.9	—0.7	—2.2	342
28	166 B.Oph	6.5	13 29.0	—1.0	—2.1	158	14 15.8	—2.8	+2.1	227

METEORS AND METEORITES

Meteor Notes from the American Meteor Society

By CHARLES P. OLIVIER, President

During the coming year our Society is going to be handicapped both by the absence of many of our best observers in military service and by the fact that most of the rest of us, who have to stay at our usual occupations, have extra duties imposed upon us by the war. While this is one of the sad conditions forced by world conditions, still it must be remembered that only by winning the war will we ever be able to pursue even science freely, and that losing it to men to whom freedom of thought is a forbidden thing would mean, among other horrors, a new intellectual dark age. Therefore in asking our members to work for the A.M.S. in 1943, I wish it most clearly understood that meteor work should always be subordinated to any efforts which will help to bring a victory. Nevertheless, there should be many on our rolls who, due to personal or local causes, would be able to do at least some observing, and to these I appeal. Everyone else, no matter where he is or how busy, could still report fireballs or other unusual phenomena. This will be the more important as ships have ceased reporting and hence that

large source of supply of fireball reports is temporarily gone. At any rate, let each of us do what he can to help the A.M.S. during 1943, be it much or little.

With regard to the principal showers: Taking the Quadrantid maximum as about Jan. 2, the Moon will be new 4 days later, hence conditions are good. Full phase on April 20 will ruin the Lyrids. This is usually a poor shower anyhow. The Moon being new on May 4 gives ideal conditions for the Eta Aquarids whose maximum falls about that date. The same phase on August 1 also gives ideal conditions for the Delta Aquarids. First quarter on Aug. 9 means that, in the late hours of Aug. 9 to 12, moonlight will not interfere with the Perseids so conditions will be good for them. Last quarter on Oct. 21 is rather unfavorable for the Orionids, so conditions for them are only fair. Full phase on Nov. 12 will pretty well ruin chances for seeing any but bright Leonids at their maximum date. Full phase on Dec. 11 will do even worse for the Geminids, which come to a maximum next day. This brief summary shows that the showers in 1943, except the Lyrids, up to and including the Perseids, come when conditions as to moonlight are favorable. I especially urge upon our members, stationed near or south of the equator, if their duties possibly permit, to try observations during the first week of May on the Eta Aquarids. Sometimes these give excellent showers, they are connected with Halley's Comet, and have not received the attention bestowed upon other prominent meteor streams. Members are further reminded that the annual dues should be paid at once. These are remitted to all men in military service, who are now members, for the duration of the war. If others would pay without bills being sent them, it would save me much trouble and the A.M.S. useless expense. Requests for maps, etc., should be sent in well in advance of probable date when they will be used.

Fireball of 1928 May 22

One of the finest fireballs which I have attempted to investigate appeared at about 11:58 P.M., E.S.T., on this date. It began over the southwestern corner of Georgia and ended over central North Carolina. Due to the late hour few observations could be obtained, though the violent vibrations and sudden light wakened thousands of people. The observations at hand are obviously rough and quite contradictory. The only conclusion about the path is that it probably started over the area between longitude 83° and 84° W, and latitude 31° to 32° N, and ended about longitude 80½° W, latitude 35° N. Nothing can be determined about the heights except that the fireball evidently burned out before it reached the horizon for the majority of the observers. Its probable duration was 6+ seconds, it was compared to the Moon in size or brightness by most observers, but it changed in both brightness and color. At first it was white or bluish, it ended as red, and its greatest brilliancy seems to have been midway along its path. For Georgia towns, $\lambda = 83°$ to 84° W and $\phi = 31° \pm$ N, vibrations were violent, rattling doors and windows. From South Carolina most observers report no sounds, and there is no report from North Carolina. One man in Virginia heard nothing. What are loosely called "explosions" seem to have been several great flareups of brilliancy along the path. No opinion can be given as to whether meteorites may have fallen from this bolide, though it must have been a fairly large body to last over a path some 500 or more kilometers long. The reports on the train are contradictory, but on the whole are against one remaining an appreciable time. This fireball, unsatisfactory as these results are, was too fine an object not to be put on record.

Fireball of 1932 April 23

On this date at 7:35 P.M., C.S.T., a bright fireball was reported as seen to the east of St. Louis. J. Wesley Simpson, then regional director in that territory, immediately began the gathering of data, both by personal interviews and by letters. All the 25 reports were sent to me soon thereafter. Unfortunately, only 4 stations at a distance from St. Louis reported and the person at one evidently suffered from hallucinations so her report was useless. One only, Anna MacNolen at W. Frankford, Illinois, gave a path referred to Ursa Major and Polaris, though even her observation did not give exact points. One other at Ridgeway, Illinois, also used Venus and Polaris, but evidently he only saw part of the path and his drawing is rough. The rest are "dead-reckonings," perhaps in some cases checked by Simpson with a compass. Unfortunately, the points of the compass, not azimuths, were reported and some were misnamed. I have interpreted as well as I could.

The fireball was seen in late twilight, by some observers in a partly cloudy sky. It was blue or blue-green in color, had an apparent disc of perhaps 10′ in diameter, and its brightness is generally compared to moonlight. Its observed duration was 4.1 seconds (mean of 23 estimates), while the train lasted only 1 or 2 seconds. It did not explode. The following data as to its path are quite uncertain, doubtless with large probable errors:

Date	1932 April 23/24 7:35 P.M., C.S.T.
Sidereal time at end point	149°
Began over	$\lambda = 88°\ 57'$ W ; $\phi = 38°\ 21'$ N
Ended over	$\lambda = 88°\ 17'$ W ; $\phi = 40°\ 41'$ N
Path approximately horizontal, height	114 km
Path length	263 km
Radiant	$a = 12°$; $h = 0° \pm$

Note: The azimuth is better determined than altitude.

I am under sincere obligations to Simpson for going to very considerable trouble in gathering the data for this fireball. It was no fault of his that the observations were so bunched and not more accordant.

Fireball of 1934 March 22

On this date at about 6:30 P.M., E.S.T., a brilliant fireball was seen from New Haven, Connecticut, by Prof. G. R. Weiland of Osburn Botanical Laboratory, Yale University. Notices put in local papers by him, requesting reports, brought in a considerable number. He also received some by telephone. At the kind suggestion of my friend, Prof. Frank Schlesinger, then director of Yale Observatory, soon thereafter he sent to me all these 28 reports to work out the fireball's path, if possible. Meantime I was able to secure through Mr. Arthur L. Day of Laconia, New Hampshire, S1, one other report from an eyewitness. These reports, on a preliminary study, did not seem to promise very much as most of the observers were in or near New Haven, so as with many similar cases it was laid aside. Now, however, I have studied them more fully and such conclusions as could be arrived at follow. Unfortunately little confidence can be placed in any of the numerical results except the height and position of the end point, which is fairly well defined. Various colors are given but the preponderance of evidence is that it was bluish. As seen from Rome, New York, S4, far to the west of the end point, the fireball just before it disappeared flashed brilliantly to twice its former size. From New Haven, S5, it was seen to break into two unequal parts,

the fainter equal to Venus, the other several times brighter. No train was left and no sounds were heard. The explosion or breaking point seems about 60 km from the end and hence at an approximate height of 55 km. The fact that the path was nearly vertical from S4 made a solution possible. The object started probably over a point just east of Providence, Rhode Island, and must have ended over South Hadley, Massachusetts. As the end point was low, and the object quite bright even in the twilight, there is a strong possibility of one or more meteorites having fallen. The numerical results follow:

Date	1934 March 22/23, 6:26 P.M., E.S.T.
Began over	$\lambda = 71° 15'$ W; $\phi = 41° 47'$ N at 109 ± 44 km
Ended over	$\lambda = 72° 35'$ W; $\phi = 42° 16'$ N at 19 ± 7 km
Length of path	155 km
Projected length of path	123 km
Observed velocity	69 km/sec
Radiant	$a = 298°$, $h = 35°$ (position very uncertain!)

Due to the great uncertainty of the height of the beginning point it was not worth while to compute the right ascensions and declinations of the radiant, or to derive the zenith correction. I am under great obligation to Prof. Weiland for sending me the data which must have given him much trouble to collect.

Flower Observatory of the University of Pennsylvania, Upper Darby, Pennsylvania, 1942 December 15.

Contributions of the Society for Research on Meteorites

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Statistical Studies of the Meteoritic Falls of the World: 4. Their Classificational Distribution[1]

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ABSTRACT

The classificational distribution of the 1,258 meteoritic falls of the world recorded in Coulson's "A Catalogue of Meteorites" (1940)[2] is studied. The essence of the paper is contained in 2 tables entitled respectively, "Classes of Meteorites and Representative Falls" and "The Classificational Distribution of the Meteoritic Falls of the World." The system of classification employed is the Rose-Tschermak-Brezina system, with the several modifications described.

Practically all of the material for the present study has been taken from A. L. Coulson's "A Catalogue of Meteorites."[2] The essence of the paper is contained in the 2 tables that follow: Table 1, "Classes of Meteorites and Representative Falls," and Table 2, "The Classificational Distribution of the Meteoritic Falls of the World."

The system of meteoritic classification employed here is virtually the Rose-Tschermak-Brezina system.[3] Authorities are generally agreed that, altho this system is far from perfect and leaves much to be desired, from both the theoretical and the practical point of view, it is, nevertheless, the most satisfactory method extant of classifying meteorites according to their salient physical characteristics. The *order* of the classes observed in this study is identical with that followed by Coulson in Ch. 3, pp. 19-29 of his catalog. However, several changes have been made in the *form* or *arrangement* of the classification, in the hope of improving it. Meteorites have been grouped primarily under the 3 universally recognized divisions, "1. Aerolites, A" (Stones); "2. Siderolites, So" (Irony Stones and Stony Irons); and "3. Siderites, Si" (Irons), instead of under the 2 headings, "1. Stones" and "2. Irons," as in the Rose-Tschermak-Brezina system. Subdivision "D. Siderolites," under "1. Stones," and subdivision "A. Lithosiderites," under "2. Irons," have, accordingly, been combined into a single *transitional* division, called "2. Siderolites," and, as a result, the classification "Lithosiderites" has been obviated. Furthermore, subdivision "C. Enstatite-Anorthite Chondrites" (which comprizes only 6 recorded examples), under "1. Stones," has been reduced to the status of the final class (no. 30) under "1. Aerolites; B. Chondrites"; thus *all* aerolites have been classified fundamentally as either "Achondrites, Ac," or "Chondrites, C." Of the 1,239 *classified* falls in Coulson's catalog, only 58 are, indeed, transitional types, or siderolites (in the present sense of that term); of these 58, the first 19 (namely, 2 not further classified; 8 mesosiderites, M; 8 grahamites, Mg; and 1 lodranite, Lo), which are most like aerolites, can, for many statistical purposes, be included with the stones, while the remaining 39 (*to wit*, 1 siderophyre, Sy, and 38 pallasites, P), which are most like siderites, can, for the same purposes, be grouped with the irons; thus a grand total of 744 "stones" and 495 "irons," so-called, is accountable.

TABLE 1

CLASSES OF METEORITES AND REPRESENTATIVE FALLS

1. AEROLITES, A^1; 725

A. *Achondrites*, Ac; 56

1. *Bustite* (called also *aubrite*), Bu; 2: Aubres, Nyons, Drôme, France; Bustee, at Basti, Basti Dist., U. P., India
2. *Chladnite* (called also *diogenite*), Chl; 5: Johnstown, Colorado; Tataouine, South Tunis
3. *Veined chladnite*, Chla; 1: Bishopville, South Carolina
4. *Whitleyite*, Wht: 1: Cumberland Falls, Kentucky
5. *Angrite* (called also *nakhlite*), An^1; 3: Angra dos Reis, Rio de Janeiro, Brazil; Nakhla, Abu Hommos, Alexandria, Egypt
6. *Chassignite*, Cha; 1: Chassigny, Haute Marne, France
7. *Amphoterite*, Am; 4: Caratash, Smyrna, Turkey, Asia Minor; Manbhoom, Manbhum Dist., Bihar, India
8. *Rodite*, Ro; 4 Ellemeet, Isle of Schouwen, Zeeland, Holland; Roda, Huesca, Spain
9. *Eukrite*, Eu; 14: Macibini, Zululand, Natal, South Africa; Moore Co., North Carolina
10. *Sherghottite*, She; 2: Padvarninkai, Androniškis Dist., Lithuania; Sherghotty, Gaya Dist., Bihar, India
11. *Howardite*, Ho; 14: Pasamonte Ranch, Union Co., New Mexico; Sioux Co., Nebraska
12. *Brecciated howardite*, Hob; 1: Jodzie, Panevezys, Kovno, Lithuania
13. *Ureilite*, U; 3: Dyalpur, Sultanpur Dist., U.P., India; Novo-Urei, Karamzinka, Nijni-Novgorod, Russia, U.S.S.R.

B. *Chondrites*, C; 566

1. *Howarditic chrondrite*, Cho; 9: Harrison Co., Ind.; Ottawa, Kansas
2. *Veined howarditic chondrite*, Choa; 1: Lalitpur, Lalitpur Dist., U.P., India
3. *White chondrite*, Cw; 61: Saint Michel, Finland; Tilden, Illinois
4. *Veined white chondrite*, Cwa; 42: Mocs, Cluj (Cojocna), Transylvania, Rumania; Modoc, Kansas
5. *Brecciated white chondrite*, Cwb; 7: Khanpur, Ghazipur Dist., U.P., India; Pacula, Jacala, Hidalgo, Mexico
6. *Intermediate chondrite*, Ci; 31: Bath Furnace, Kentucky; Colby, Wisconsin
7. *Veined intermediate chondrite*, Cia; 30: Long Island, Kansas; New Concord, Ohio
8. *Brecciated intermediate chondrite*, Cib; 8: Chandakapur, Chikhli tahsil, Buldana Dist., C.P., India; L'Aigle, Orne, France
9. *Gray chondrite*, Cg; 60: Archie, Missouri; Paragould, Arkansas
10. *Veined gray chondrite*, Cga; 33: Monroe, North Carolina; Pultusk, Warsaw, Poland
11. *Brecciated gray chondrite*, Cgb; 38: Homestead, Iowa; Lake Labyrinth, South Australia
12. *Orvinite*, Co; 1: Orvinio, Rome, Italy
13. *Tadjerite*, Ct; 1: Tadjera, Sétif, Constantine, Algeria
14. *Black chondrite*, Cs; 16: McKinney, Texas; Rose City, Michigan
15. *Veined black chondrite*, Csa; 2: Farmington, Kansas; Rosebud, Texas
16. *Carbonaceous chondrite*, K; 13: Cold Bokkeveld, Cape Prov., South Africa; Orgueil, Montauban, Tarn-et-Garonne, France
17. *Spherical carbonaceous chondrite*, Kc; 2: Felix, Alabama; Lancé, Vendôme, Loir-et-Cher, France
18. *Veined spherical carbonaceous chondrite*, Kca; 1: Indarch, Shusha, Elisavetpol, Azerbaijan, Russia, U.S.S.R.
19. *Spherical chondrite*, Cc; 72: Hessle, Upsala, Sweden; Selma, Alabama
20. *Veined spherical chondrite*, Cca; 15: Covert, Kansas; Richardton, North Dakota
21. *Brecciated spherical chondrite*, Ccb; 15: Forest City, Iowa; Weston, Connecticut
22. *Ornansite*, Cco; 4: Allegan, Michigan; Ornans, Doubs, France
23. *Ngawite*, Ccn; 1: Ngawi, Gentoeng, Madioen, Java
24. *Crystalline spherical chondrite*, Cck; 17: Holbrook, Arizona; Richmond, Virginia
25. *Veined crystalline spherical chondrite*, Ccka; 1: Meuselbach, Thuringia, Germany
26. *Brecciated crystalline spherical chondrite*, Cckb: no example known to the writer
27. *Crystalline chondrite*, Ck; 30: Gilgoin Sta., Brewarrina, Clyde Co., New South Wales, Australia; Harrisonville, Missouri
28. *Veined crystalline chondrite*, Cka; 6: Estacado, Texas; Tulia, Texas
29. *Brecciated crystalline chondrite*, Ckb; 5: Bluff, Texas; Ensisheim, Alsace, France
30. *Crystalline enstatite-anorthite chondrite*, Cek; 6: Daniel's Kuil, Griqualand West, South Africa; Khairpur, Bahawalpur State, Punjab States, India

2. Siderolites, So; 58

1. *Mesosiderite*, M; 8: Estherville, Iowa; Mincy, Arkansas
2. *Grahamite*, Mg; 8: Crab Orchard Mountains, Rockwood, Cumberland Co., Tennessee; Winona, Arizona
3. *Lodranite*, Lo; 1: Lodran, Multan Dist., Punjab, India
4. *Siderophyre*, Sy^2; 1: Steinbach, Erzegebirge, Saxony, Germany
5. *Pallasite, Krasnojarsk group*, Pk; 7: Krasnojarsk, Yeniseisk, Siberia, U.S.S.R.; Springwater, Saskatchewan, Canada
6. *Pallasite, Rokicky group*, Pr; 10: Admire, Kansas; Brahin, Rechitza Dist., Minsk, Russia, U.S.S.R.
7. *Pallasite, Imilac group*, Pi; 5: Imilac, Desert of Atacama, Chile; Molong, Ashburnham Co., New South Wales, Australia
8. *Pallasite, Bitburg* (called also *Albacher*) *group*, Pb (or Pa); 1: Bitburg, Trier, Rhenish Prussia, Germany

3. SIDERITES, Si[2]; 456

A. *Octahedrites*, O; 323

1. *Finest octahedrite*, Off; 17: Bacubirito, Sinaloa, Mexico; Tazewell, Tennessee
2. *Fine octahedrite, Victoria group*, Ofv; 1: Victoria West, Cape Prov., South Africa
3. *Fine octahedrite*, Of[3]; 52: Carlton, Texas; Duchesne Co., Utah
4. *Medium octahedrite*, Om[3]; 149: Henbury, MacDonnell Ranges, Central Australia; Xiquipilco (= Toluca), Mexico State, Mexico
5. *Coarse octahedrite*, Og[3]; 63: Canyon Diablo, Arizona; Odessa, Texas
6. *Coarsest octahedrite*, Ogg; 18: Arispe, Sonora, Mexico; Union Co., Georgia
7. *Brecciated octahedrite, Kodaikanal group*, Obk; 1: Kodaikanal, Palni Hills, Madura Dist., Madras, India
8. *Brecciated octahedrite, Netschaëvo group*, Obn; 1: Netschaëvo, Tula, Russia, U.S.S.R.
9. *Brecciated octahedrite, Zacatecas group*, Obz; 2: Barranca Blanca, Come Caballo Pass, Atacama, Chile; Zacatecas, Mexico
10. *Brecciated octahedrite, N'Goureyma group*, Obzg; 1: N'Goureyma, Jenne, Massina, French West Africa
11. *Brecciated octahedrite, Copiapo group*, Obc; 3: Copiapo, Atacama, Chile; Four Corners, New Mexico
12. *Octahedrite, Hammond group*, Oh; 3: Cacaria, Durango, Mexico; Hammond Twp., Saint Croix Co., Wisconsin

B. *Hexahedrites*, H;[4] 31

1. *Normal hexahedrite*, Hn;[4] 23: Braunau, Trutnov, Bohemia, Czechoslovakia; Coahuila, Mexico
2. *Granular hexahedrite*, Ha; 1: Summit, Alabama
3. *Brecciated hexahedrite*, Hb; 7: Ballinger, Texas; Kendall Co., Texas

C. *Ataxites*, D;[5] 53

1. *Nickel-rich ataxite, not further classified*, D_1; 6: Hoba West, near Grootfontein, Southwest Africa; Washington Co., Colorado
2. *Nickel-rich ataxite, Cape group*, Dc; 5: Cape of Good Hope, Cape Prov., South Africa; Kokomo, Indiana
3. *Nickel-rich ataxite, Shingle Springs group*, Dsh; 1: Shingle Springs, California
4. *Nickel-rich ataxite, Babb's Mill group*, Db; 8: Babb's Mill, Greene Co., Tennessee; Oktibbeha Co., Mississippi
5. *Nickel-rich ataxite, Linville group*, Dl; 3: Linville Mountain, Burke Co., North Carolina; San Cristobal, Antofagasta, Chile
6. *Nickel-poor ataxite, not further classified*, D_2; 10: Aragon, Georgia; Navajo, Arizona
7. *Nickel-poor ataxite, Nedagolla group*, Dn; 4: Forsyth Co., North Carolina; Nedagolla, Vizagapatam Dist., Madras, India
8. *Nickel-poor ataxite, Siratik group*, Ds; 9: Chesterville, South Carolina; Siratik, Upper Senegal, West Africa
9. *Nickel-poor ataxite, Primitiva group*, Dp; 3: La Primitiva, Santa Catalina, Desert of Tarapaca, Chile; Tombigbee River, Choctaw and Sumter Co., Alabama
10. *Nickel-poor ataxite, Muchachos group*, Dm; 1: Tucson, Arizona

NOTES TO TABLE 1

[1] It is proposed that the symbol "A" be reserved for *aerolite* (generally) and that "An" be used for *angrite*.

[2] It is proposed that the symbol "Sy" be used for *siderophyre* and that "Si" be reserved for *siderite* (generally).

[3] Additional classes: *fine octahedrite, fused*, Ofe; *medium octahedrite, fused*, Ome; and *coarse octahedrite, fused*, Oge, follow immediately after classes Of, Om, and Og, respectively, in the Rose-Tschermak-Brezina classification as quoted by Farrington in *Meteorites*, p. 202, but are here omitted.

[4] It is proposed that the symbol "H" be reserved for *hexahedrite* (generally) and that "Hn" be used for *normal hexahedrite*.

[5] In the opinion of the writer, "X" would be a better symbol for *ataxite* than "D," but he hesitates to make the change.

In Table 1 are listed, in order, the name of each category of meteoritic fall; its symbol; the number of known falls in the category in question (according to Coulson's catalog); and the names of 1 or 2 falls that are typical of each class (2, if 2 or more such falls are known). Well-known falls are enumerated as examples wherever available, and the prototype is mentioned in every case in which the class has received its name from the name of a fall.

TABLE 2

THE CLASSIFICATIONAL DISTRIBUTION OF THE METEORITIC FALLS OF THE WORLD‖.

Cl.	*No.*	*%*	*Cl.*	*No.*	*%*
*Mi**	*1,258*	——	(33) Kca	1	0.2
Mi†	19	1.5	(34) Cc	72	13.6
			(35) Cca	15	2.8
Mi§	*1,239*	98.5	(36) Ccb	15	2.8
A*	725	58.5	(37) Cco	4	0.8
A†	103	8.3	(38) Ccn	1	0.2
			(39) Cck	17	3.2
A§	*622*	50.2	(40) Ccka	1	0.2
Ac*	56	9.0	(41) Cckb	0?	0.0
(1) Ac†	1	0.2	(42) Ck	30	5.7
			(43) Cka	6	1.1
Ac§	*55*	8.8	(44) Ckb	5	1.0
(2) Bu	2	3.6	(45) Cek	6	1.1
(3) Chl	5	9.1			
(4) Chla	1	1.8	*Mi*§	*1,239*	——
(5) Wht	1	1.8	So*	58	4.7
(6) An	3	5.4	So†	2	0.2
(7) Cha	1	1.8			
(8) Am	4	7.3	*So*§	*56*	4.5
(9) Ro	4	7.3	(46) M	8	14.3
(10) Eu	14	25.4	*Cl.*	*No.*	*%*
(11) She	2	3.6	*Cl.*	*No.*	*%*
(12) Ho	14	25.4	*Cl.*	*No.*	*%*
(13) Hob	1	1.8	(47) Mg	8	14.3
(14) U	3	5.4	(48) Lo	1	1.8
			(49) Sy	1	1.8
A§	*622*	——	P*	38	67.9
C*	566	91.0	(50) P†	15	26.8
(15) C‡	38	6.1			
			P§	*23*	41.1
C§	*528*	84.9	(51) Pk	7	30.4
(16) Cho	9	1.7	(52) Pr	10	43.5
(17) Choa	1	0.2	(53) Pi	5	21.7
(18) Cw	61	11.6	(54) Pb	1	4.4
(19) Cwa	42	8.0			
(20) Cwb	7	1.3	*Mi*§	*1,239*	——
(21) Ci	31	5.9	Si*	456	36.8
(22) Cia	30	5.7	Si†	49	4.0
(23) Cib	8	1.5			
(24) Cg	60	11.4	*Si*§	*407*	32.8
(25) Cga	33	6.2	O*	323	79.4
(26) Cgb	38	7.2	(55) O†	10	2.5
(27) Co	1	0.2			
(28) Ct	1	0.2	*O*§	*313*	76.9
(29) Cs	16	3.0	(56) Off	17	5.4
(30) Csa	2	0.4	(57) Ofv	1	0.3
(31) K	13	2.5	(58) Of	52	16.6
(32) Kc	2	0.4	(59) Om	149	47.6

TABLE 2 (CONTINUED)

Cl.	*No.*	*%*	*Cl.*	*No.*	*%*
(60) Og	63	20.1	(72) D†	3	0.7
(61) Ogg	18	5.8			
Ob*	10	3.2	*D*§	*50*	12.3
(62) Ob†	2	0.6	D_1*	23	46.0
Ob§	8	2.6	(73) D_1†	6	12.0
(63) Obk	1	0.3			
(64) Obn	1	0.3	D_1§	*17*	34.0
(65) Obz	2	0.6	(74) Dc	5	29.4
(66) Obzg	1	0.3	(75) Dsh	1	5.9
(67) Obc	3	1.0	(76) Db	8	47.1
(68) Oh	3	1.0	(77) Dl	3	17.6
Si§	*407*	——	*D*§	*50*	——
			D_2*	27	54.0
*H**	*31*	7.6	(78) D_2†	10	20.0
(69) Hn	23	74.2			
(70) Ha	1	3.2	D_2§	*17*	34.0
(71) Hb	7	22.6	(79) Dn	4	23.5
			(80) Ds	9	52.9
Si§	*407*	——	(81) Dp	3	17.6
D*	53	13.0	(82) Dm	1	5.9

NOTES TO TABLE 2

‖ "Mi" is the symbol used below for *meteorite(s)* or *meteoritic fall(s)*.
*Total number of falls.
†Not further classified.
‡Not further classified, except for veining and brecciation.
§Further classified.

In the first column to Table 2, headed "Cl.," all the categories are arranged in order, by symbol, the *specific classes* (82 in all) being numbered consecutively (in parentheses) throughout the table. In the second column, entitled "No.," is listed the number of known falls of each category. In the third column, headed "%," the number is in each case the percentage obtained by dividing the *nearest preceding number* (No.) in the second column, *printed in italics—i.e.*, the number (No.) at the head of either the subcolumn in question or the subcolumn immediately preceding, and corresponding to the *italicized symbol* in the first column—by the given number (No.). With this clarification, the information presented in Table 2[4] is, it is believed, sufficiently self-explanatory to require no further comment.

NOTES

[1] "Studies: 3. Their Time Distribution" appeared in *C.S.R.M.*, **2**, 309-18, 1938-41; *P. A.*, **49**, 551-60, 1941.

[2] *Mem. Geol. Surv. India*, **75**, 346 pp., 6 pl., 1940; reviewed in *C.S.R.M.*, **2**, 201, 1938-41; *P. A.*, **48**, 383-4, 1940.

[3] See, *e.g.*, O. C. Farrington's *Meteorites*, Ch. 12, "Classification of Meteorites," pp. 197-204, 1915.

[4] See also the 4th par., pp. 232-3, Ch. 5, of Coulson's catalog.

The South Strafford, Vermont, Meteorite (Siderite)

The discovery, in August, 1942, of an octahedrite weighing 5 lb., 2 oz. (2.3247 kg.), which he calls the South Strafford, Vermont, meteorite, is announced by Charles G. Doll of the University of Vermont in *Sci., N.S.*, **96**, 494, 1942. This is the first meteorite reported for the State of Vermont; the specimen was not seen to fall. South Strafford is in Orange County; the coördinate number (or numeri-

cal designation) of the meteorite (*cf. C.S.R.M.*, **2**, 270, 1938-41; *P. A.*, **49**, 214-15, 1941) is 0724438.—F.C.L.

Patron and Fellows Elected

Under date of 1942 December 1, the Council has elected Dr. Curvin H. Gingrich, Editor of POPULAR ASTRONOMY, Goodsell Observatory, Carleton College, Northfield, Minnesota, a patron of the Society, and the following 2 members to fellowship in the Society:

Mr. C. P. Butler, Smithsonian Solar Observatory, Box 2, Swartout, California;

Mr. Franklin O. Wisman, 401 Bendix Dr., South Bend, Indiana.

C. H. CLEMINSHAW, *Secretary*

Prices of Farrington's "Meteorites" Reduced

The Executive Committee of the Council has reduced the price of O. C. Farrington's "Meteorites" (233 pp., 1915) from $2.50 to $1.50 per copy to members of the Society and to dealers, and from $3.50 to $2.00 per copy to all other nonmembers, plus 10 cents in each case for the cost of mailing. The new prices became effective on 1942 December 1. Copies of the book may be ordered from the Secretary of the Society at the Griffith Observatory, Box 9866, Los Feliz Station, Los Angeles, California.

C. H. CLEMINSHAW, *Secretary*

VARIABLE STARS

Variable Star Notes from the American Association of Variable Star Observers

By LEON CAMPBELL, Recorder

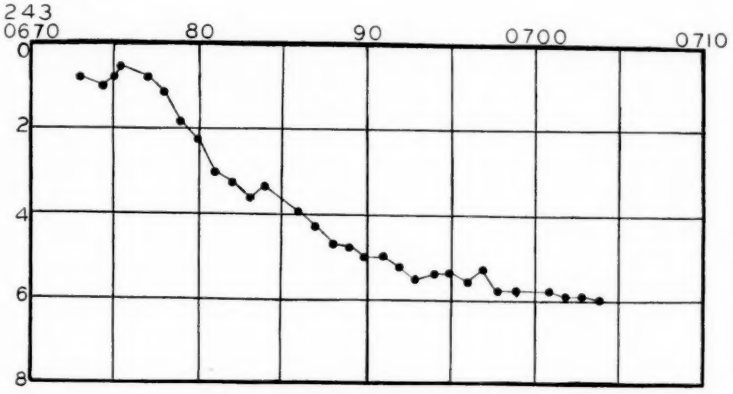
Nova Puppis 1942: As mentioned briefly in the December Notes, a bright naked-eye nova was discovered by Professor B. H. Dawson of La Plata, Argentina, probably in the early hours of November 9, 1942. The cable announcement stated that the nova was nearly of the first magnitude. Because of the southern location of La Plata, the star was doubtless readily observable at an earlier hour than in the northern hemisphere, the star passing not far from the zenith at La Plata, while in the United States it was relatively close to the southern horizon.

In spite of its low altitude, the nova was no doubt seen on the morning of November 9, by numerous persons, especially early risers engaged in defense industries. Mr. F. Hartmann, of St. Albans, New York, noticed the presence of the bright star while waiting for an early bus. Others noted the strange object at an early hour while gathering up their morning newspapers.

Mr. Herbert Luft, of Sao Paulo, Brazil, discovered the nova independently on the evening of November 10, while carrying on his regular nova search program. He had just finished his examination of Regions 135 and 136 when his attention was attracted to the strange object near Zeta Puppis, and he immediately recognized the star as a nova. Although he promptly notified the Cordoba Observatory of his discovery, he had later to learn that other discoveries had preceded him.

The first observation made at Harvard was on the morning of November 11, when the brightness of the nova was estimated at 0.8. Beginning on November 12, numerous observations were made in various sections of this country, and, to date, December 11, 130 observations have been made and communicated to the A.A.V.S.O. headquarters, covering every day but two. Doubtless these missing dates will be covered when reports from other observers are received, especially from those in the southern hemisphere.

The nova appears to have reached its maximum brilliance on the morning of November 12, magnitude 0.5 From that time the decrease in light has been steady, at the rate of a magnitude in two days at first, then gradually slowing down until at the beginning of December it was decreasing at the rate of about a magnitude in ten days.



LIGHT CURVE OF NOVA PUPPIS 1942

In the table are given the mean daily magnitudes of all the observations so far received. These are illustrated in the accompanying figure on a scale of two magnitudes per five days.

OBSERVATIONS OF NOVA PUPPIS

J.D.	*Mean Mag.*	*No. of Obs.*	*J.D.*	*Mean Mag.*	*No. of Obs.*
2430673.0	0.83	3	0689.0	4.8	1
74.3	1.00	4	89.8	5.00	2
74.9	0.70	4	90.9	5.05	2
75.9	0.50	5	91.9	5.25	4
77.0	0.74	5	92.9	5.50	3
77.9	1.16	16	93.9	5.43	3
78.9	1.85	12	95.0	5.40	2
79.9	2.32	9	96.0	5.6	1
80.9	2.99	7	97.0	5.53	3
81.9	3.23	6	97.8	5.80	3
82.9	3.61	8	98.8	5.80	3
83.9	3.35	2	0700.8	5.80	2
85.9	3.96	5	01.8	5.93	3
86.9	4.29	7	02.8	5.9	1
88.0	4.70	3	03.8	6.0	1

Naturally, conjectures were made as to how the nova would behave in the

next few days or weeks. At first, especially from the behavior of the spectrum, it was thought by some that it might be another example of Nova Herculis 1934, but this idea was soon dispelled. It begins to look as if the nova may follow the course of the more rapidly fading novae. The nova decreased five magnitudes in the twenty days following maximum, a large amount for any nova. The Harvard plates fail to show the nova in its pre-maximum stage, while stars of approximately the seventeenth magnitude are seen on the long-exposure plates. The increase in magnitude must have been about seventeen magnitudes, or an intensity of six million times its original brightness, more like the range of the supernovae. The average range in magnitude of normal novae appears to be nearer thirteen magnitudes.

While Nova Puppis can be observed for some months to come in the northern hemisphere, even if under somewhat unfavorable conditions, it is to be hoped that observers in South America and South Africa will continue to observe it for a long time. Since this nova is the brightest which has appeared in over twenty years (Nova Aquilae 1918 attained magnitude —1.0), it will be important to follow its light variations with much care. The sudden appearance of Nova Puppis is excellent proof of the value of nova searching, which requires mainly a ready knowledge of the naked-eye constellations, and plenty of perseverance.

The R Coronae Borealis Variables: The three R Coronae stars which have been at or near minimum in recent months are now on the increase to maximum. The increase of R Coronae Borealis itself from magnitude 12.5 has been rapid, magnitude 9.0 having been attained on November 28, while that of SU Tauri has been more gradual. This star has risen from magnitude 13.5 or fainter to 11.7 during the past three months.

RY Sagittarii decreased to tenth magnitude early in November. Late observations make it apparently on the rise again, but the region is now unfavorably placed for observation. The unexpected may still happen for all of these peculiar variables, so one must be prepared for surprises. They may continue their course to full maximum light, or suddenly decrease to further minimum light again.

Personal: News, much belated, has been recently received in this country of the death on May 15, 1942, of Dr. Felix de Roy of Antwerp, Belgium.

By profession a newspaper editor, Dr. de Roy was for many years one of the leading European amateur astronomers and served as an able Director of the Variable Star Section of the British Astronomical Association. The publication of Volumes 28 and 31 of the *Memoirs* of the Association will long stand as a memorial to his directorship during the years 1922 to 1939. In these two volumes are collected more than 100,000 observations of long-period variables.

In 1936, Dr. de Roy received the degree of Doctor in Mathematics and Physics *honoris causa* from the University of Utrecht, in recognition of his thirty years work in astronomy. He was an honorary member of the American Association of Variable Star Observers, and a valued member of the Variable Star Commission of the International Astronomical Union.

The passing of Dr. de Roy will be keenly felt by his host of friends, not only in Europe but also in America where, in 1932, he spent many months in research on variable stars at the Harvard Observatory.

Observations received during November, 1942:

Name	Var.	Obs.	Name	Var.	Obs.
Ashbrook	1	1	Kearons, Mrs.	81	130
Bappu	22	68	Kelly	13	13
Blunck	21	28	Koons	101	212
Boone	7	7	Lange	4	4
Bouton	86	166	Lovinus	22	26
Buckstaff	16	49	Luft	3	30
Campbell	1	8	Manlin	11	13
Carpenter	6	6	Maupomé	122	130
Cornell	1	1	Meek	28	183
deKock	65	297	Monnig	1	6
Duffie	22	30	Morgan	1	5
Erdman	21	34	Nadeau	44	54
Farnsworth, Miss	1	1	Parker	31	41
Fernald	305	624	Parks	23	39
Friend	1	1	Peltier	81	126
Gaposchkin	1	10	Rosebrugh	1	6
Garneau	18	24	Schoenke	21	36
Halbach	65	71	Shapley	1	1
Hale	1	2	Sill	80	81
Harris, H. M.	70	71	Topham	133	133
Harris, R. G.	4	4	Vohman	24	28
Hart	11	11	Webb	23	29
Hartmann	143	198	Weber	100	100
Herbig	23	32	Whitney	1	3
Holt	141	280	—		—
Jacchia	1	1	51	Totals	3490
Jones	36	36			

December 14, 1942.

Comet Notes

By G. VAN BIESBROECK

Comet 1942 *e* (Oterma) has been well observed since its discovery announced last month. By means of positions on November 5, 11, and 14, the first one depending on a prediscovery plate obtained at the Harvard College Observatory, the following preliminary orbits have been computed:

Computer	F. L. Whipple	Bobone	Comet 1867 I (Stephan)
Longitude of Node	78° 30'.8	78° 30'	79° 30'.3
Node to Perihelion	358 3.0	358 11	357 31.4
Inclination	17 57.6	17 54	18 13.2
Perihelion Time	1942 Dec. 18.859	1942 Dec. 18.973	1867 Jan. 20.207
Eccentricity	0.86622	0.8597	0.86535
Perihelion Distance	1.60001	1.617	1.57723
Period	41.4 years	38.3	40.1±2.0

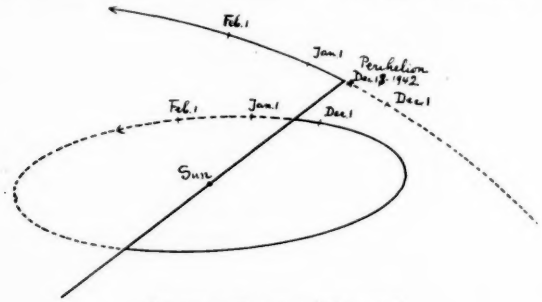
In communicating his result F. L. Whipple notes that the elements are essentially identical with those of Comet 1867 I which are given in the last column, referred also to the equinox of 1942. This last orbit deduced by L. Becker from all the observations of Stephan's Comet, covering the interval of 1867 January 20 to April 3, left an uncertainty of two years in the period of revolution around the Sun. If we combine the two apparitions the period comes out 37.96 years so that the identity can hardly be questioned. The small differences in the elements are undoubtedly to be attributed to planetary perturbations during the interval of the two returns. There is the additional evidence that Stephan's description of the

object corresponds very well to the present appearance of a somewhat eccentric nucleus. In the beginning of 1905 the comet must have been visible under nearly the same conditions as at present but it evidently escaped detection.

The course of the comet during the coming month is shown by the following ephemeris derived by P. Herget from observations Nov. 5 (Harv.), Nov. 15 and Dec. 1 (Wash.) with a period conditioned to 38 years:

1943 UT	α (1943) h m	δ ° ′	Mag.
Jan. 4.0	4 6.4	+26 55	
8.0	9.6	28 36	10.5
12.0	13.5	30 11	
16.0	18.1	31 39	
20.0	23.4	32 59	
24.0	29.3	34 12	
Jan. 28.0	4 35.9	+35 18	11.0

The orbit is represented herewith in relation to the elliptic orbit of the earth. The apparent path of the comet now lies across the constellation of Taurus. In February the comet enters the constellation of Auriga which will then be very



ORBIT OF COMET *c* (OTERMA)

well placed for northern observers. However, the maximum brightness was due in the middle of December and a decrease is expected after that time. My estimations of total brightness obtained here extrafocally with the 24-inch reflector run as follows:

	Mag.		Mag.
1942 Nov. 11	10.6	Nov. 27	10.2
13	10.6	Dec. 2	10.0
14	10.5	3	9.7
18	10.5	5	9.3

On the last date the nucleus was well defined; the coma spread into a short fan in the second quadrant but besides there appeared a faint, very diffuse tail on the preceding side of the nucleus, extending over a length of 12′.

The recovery of this object after an interval of 76 years will make it possible to determine accurately the orbit of this new member of the growing family of the periodic comets.

PERIODIC COMET WOLF I. It was mentioned previously (p. 514) that this faint comet would probably be missed at its present opposition. From Mt. Wilson Observatory word has come that Dr. W. Baade fortunately found the object on a plate taken with the 100-inch reflector on November 5. At that time the cor-

rection of Kamienski's ephemeris was +11^{s}2 and —49″ and the magnitude 19.3 which is as faint as any comet has ever been recorded. Dr. Baade reports further observations on Nov. 6 and 8 and describes the tiny object as having a practically stellar nucleus but showing a neat little tail 16″ long in position angle 300°. He corrects to 18.6 mag. the brightness at first given as 19.3. It is doubtful if this comet will be located again in the future: it has shown a definite decrease in brightness at every successive return since its discovery by Max Wolf in 1884.

Periodic Comet Schwassmann-Wachmann I is still under observation and has continued to show large variations in brightness. On Dec. 8 and 9 it appeared as a very small nebulosity with a well-defined central nucleus. The brightness was estimated as 14.5 which is two or three magnitudes brighter than it was in October.

Two periodic comets are expected in the early part of 1943. The first, Comet Reinmuth, was due at perihelion Dec. 5, 1942, but it is most favorably placed toward the end of February. It will, however, be in reach of larger telescopes only. The second is Comet Neujmin (2) which has not been seen since 1927, although it returned to perihelion in 1932 and 1937. Minimum distance from the Sun is expected April 27, 1943, but the object is already well located before that date. The search ephemerides for these two comets are reproduced here from the "Handbook of the British Astr. Assoc." for 1943:

Comet Reinmuth

1943	α (1943.0) h m	δ ° ′
Jan. 2	11 49.3	+ 6 1
10	11 58.4	5 57
18	12 6.0	6 6
26	11.8	6 30
Feb. 3	15.6	7 8
11	17.5	7 59
19	17.4	9 0
27	15.4	10 7
Mar. 7	12 12.0	+11 15

Comet Neujmin (2)

1943	α (1943.0) h m	δ ° ′
Jan. 4	4 37.1	+40 41
12	29.8	39 21
20	26.2	37 51
28	26.5	36 19
Feb. 5	30.7	34 49
13	38.7	33 22
21	4 49.9	32 1
Mar. 1	5 4.1	30 41
9	5 20.9	+29 21

Williams Bay, Wisconsin, December 11, 1942.

General Notes

Dr. Henry Gordon Gale, professor of physics and dean emeritus of the Division of Physical Sciences of the University of Chicago, died on November 16 at the age of sixty-eight years.—*Science,* November 27, 1942.

Professor A. E. Douglas, formerly director of the Steward Observatory, University of Arizona, has been recalled from retirement to resume the same position. This was necessitated by the absence of Dr. Edwin F. Carpenter who is now on the staff of the Officer's School at Ithaca, N. Y. Dr. Paul Jose and Mr. J. F. Foster are the other members of the staff at the Steward Observatory for this year.

Dr. Edward A. Fath, director of Goodsell Observatory and a member of the Board of Collaborators of Popular Astronomy, and Mrs. Olive M. Hawver, for some time the secretary, accountant, and circulation manager of Popular Astron-

OMY, were married at the home of Mrs. Hawver's mother, Mrs. J. T. Killen, in Northfield on Saturday, December 19, 1942. They will reside at 703 East Fourth Street, Northfield, Minnesota.

Rittenhouse Astronomical Society, of Philadelphia, held its monthly meeting on Friday, December 11, 1942, in the Lecture Hall of the Franklin Institute. Dr. Svien Rosseland, formerly Director of the Astrophysical Institute, Oslo, Norway, and now a member of the Princeton University Astronomy Department, gave an address on the subject, "Pulsating Stars."

Having been invited to come to Princeton, Dr. Rosseland was denied permission to leave Nazi-dominated Norway, so he and his family escaped on foot across the border to Sweden, from there going to Russia, Japan, and Honolulu. He is the author of a standard treatise on astrophysics.

Air Navigation for Global War

The above is the title of a timely discussion in the issue of *Fortune* for December 28. It presents a much simplified method of determining positions on the Earth's surface quickly and accurately. The method was devised by Drury A. McMillen, business man and engineer. The paper points out that the speed with which airplanes travel has rendered former methods, which are entirely adequate for comparatively slow sailing, completely antiquated.

Book Reviews

Astronomy, Maps, and Weather, by C. C. Wylie. x + 449 pp. (New York, Harper & Brothers, August, 1942. $3.00.)

Map Reading and Avigation, by Richard M. Field and Harlan T. Stetson. xiii + 129 pp. (New York, D. Van Nostrand Co., September, 1942. $2.50.)

The Practical Essentials of Pre-Training Navigation, by William T. Skilling and Robert S. Richardson. v + 113 pp. (New York, Henry Holt and Company, September, 1942. $0.75.)

These three new texts show how widely astronomers can differ in their selection of "those features of astronomy which are essential for navigation" for the pre-training college courses recommended by the Army Air Corps Flying Training Command. Restricting ourselves, as we shall in this review, to the purely astronomical portions of the texts, we find that Wylie has presented a work which departs only slightly from a standard Astronomy 1 text, except for the necessarily greater emphasis upon practical astronomy. Field and Stetson, by contrast, have eliminated everything which does not bear directly upon the solution of problems in celestial navigation by means of the *Air Almanac* and *HO214*. Skilling and Richardson come somewhere in between, tending more toward the practical approach of Field and Stetson, but including some topics which are a part more of the historical background than of present-day practical air navigation.

To this reviewer the phrase "astronomy . . . essential for navigation"[1] means

[1] From a letter on "academic pre-training for aviation cadets" from Major General Barton K. Yount, Air Corps Flying Training Command.

celestial navigation, a term sufficiently broad to cover the astronomical concepts which are fundamental to navigation, and also the tables, graphs, and instruments which are being used at the present time. This implies a sympathy with views already expressed[2] in favor of teaching only those portions of astronomy which are strictly and practically applicable to navigation. The inability of the Air Corps to provide sextants for practice in the universities does not mean that practical experience in navigational calculations and a thorough understanding of the processes used need give way to generalities. The *Air Almanac* and *HO214* are available to all; most astronomical departments, moreover, already possess marine sextants, which provide valuable experience at least preparatory to the use of bubble sextants. Some have been able to obtain bubble sextants; it may be that others still can.

The means thus being available for the teaching of practical celestial navigation, there seems to be little justification for deliberately avoiding it in university courses, in favor of "background." The instructor must recognize that his students will inevitably include not only prospective Army fliers, but also members of the Naval R.O.T.C., of the Naval and Marine Corps Reserves, candidates for the Merchant Marine, and, last but not least, for the air transportation companies which are at present demanding many navigators for the ferrying and transport services they are so rapidly expanding. It is to be hoped that the universities will attempt to meet the needs of these students, not merely to bolster falling enrollment in Astronomy 1. Their failure to do so thus far has resulted in the establishment throughout the country of fly-by-night schools which are charging exorbitant prices for rule-of-thumb teaching by instructors of meager background.

Rule-of-thumb navigation instruction is widespread at the present time in both armed and civilian services, and it seems that astronomers, though possessing the fundamental knowledge and, in most cases, the teaching experience necessary to thoroughgoing courses in celestial navigation, have been too reticent in pressing their case. The background type of course indicated by Professor Wylie's text and the authority seemingly behind it has tended instead to foster the notions that college professors can't teach anything practical and that navigation (confused with seamanship) should be taught by men with practical experience. By contrast with these ideas, letters which this reviewer has received from former students in three such service schools (none in the Air Corps) complain that the navigation instruction is both hasty and poor. Perhaps it is time for us to point out that celestial navigation is a branch, not of practical experience, but of mathematical astronomy.

In presenting the modern methods used in celestial navigation in a way which will not encumber his students with superfluous ideas, the astronomer will have to revise or discard, nevertheless, many of the concepts and procedures with which he has grown up. For example, the formula

$$\text{LHA} = \text{GHA} \pm \text{Long}$$

should be established directly by diagram, not by reference to formulae involving local civil or local apparent time, or right ascension and local sidereal time, as Wylie does on pp. 262-3. These terms have been discarded in practice, and should be almost completely discarded in teaching, in favor of Greenwich hour angle

[2] *Science-Supplement*, **2477**, 12-13, June 19, 1942; and *Science*, **2498**, 449-50, November 13, 1942.

and sidereal hour angle, which, it should be noted, are just as fundamental concepts, even though unsanctified by time. Skilling and Richardson provide such diagrams, but tend, nevertheless, to overemphasize sidereal time and right ascension. Both texts stress the subject of time, whereas the navigator today has little use for any kind of time other than G.C.T. Even Greenwich sidereal time he encounters only as GHA ♈, measured in arc, not time. The older procedures are still possible as alternative solutions with the *Nautical Almanac*, but the young navigator needs only a cursory acquaintance with them in the event he has to serve under an unprogressive superior who learned his navigation forty years ago.

Similar remarks may be applied to the haversine formulas, which are discussed by Wylie and by Skilling and Richardson. These formulas are no more fundamental, and not much more hoary, than the split-triangle tables and formulas developed first by Lord Kelvin and best known to Americans in the present-day *HO208* (Dreisonstok) and *HO211* (Ageton), which relegated the haversine tables of Bowditch to a position of historical interest even before the advent of *HO214* and *HO218*.

Professor Wylie's text has many things to recommend it. The drawings and illustrations are excellent, especially the star charts in the second chapter, which show the principal stars and constellations distinctly and ingeniously. Throughout the work are many illuminating passages on the astronomical background of navigation which both the navigator and the astronomer can read with profit. The summary of non-navigational astronomy in the latter two-fifths of the book is well presented and illustrated. It is a work which every navigator would enjoy and profit by having in his library, and should serve as an excellent text for those who agree with Professor Wylie's point of view on the teaching of navigation rather than that expressed by this reviewer.

The other two texts both show the effects of the haste in which they were produced, that of Professor Skilling and Dr. Richardson in such errors of detail as the instructions for constructing a Mercator chart (p. 12), that of Professors Field and Stetson in the organization and presentation of the material and by sundry omissions. The first may be praised for its many diagrams and complete development of the necessary navigational ideas. It is a useful adjunct to Bowditch and other government publications in that it presents the astronomical ideas more fully than they do. Professors Field and Stetson include very useful sample pages from the *Air Almanac* and *HO214*, with which practice problems may be worked.

It is to be hoped that each of these texts, upon revision, will profit from a study of the best features of the others.

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The lateness of mailing of this issue is due to printing difficulties, which in turn are due to conditions induced by the war. We know our subscribers will readily understand and accept this explanation.

We extend to all of them belated, but none the less hearty, Good Wishes for the New Year. EDITOR.